

UNIVERSITY LIBRARY OF MICHIGAN

XXIII

JUN 19 1923
MAY-JUNE, 1923

No. 3

NATURAL HISTORY

BALUCHITHERIUM

The giant fossil rhinoceros of Mongolia, and his relatives
BY HENRY FAIRFIELD OSBORN

BIRD VOICES OF THE NORTHERN WOODS

Songs and calls of the feathered visitors to Arnprior, Ontario
BY CHARLES MACNAMARA

MAN AS A MUSEUM SUBJECT

Landmarks in the development of the department of anthropology
BY CLARK WISSLER

THE BURIED PAST OF MEXICO

Opportunities for archaeological work in the Republic
BY CLARENCE L. HAY

MONKEYS TRAINED AS HARVESTERS

A practice, old as the tombs of Egypt, that still persists
BY E. W. GUDGER

NATURE AND HUMAN NATURE IN A PROBATIONARY CLASSROOM—
THE BUFFALO DRIVE—THE NATIVES OF SOUTH
AFRICA—JUMPING “SEEDS”

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

ANNUAL SUBSCRIPTION \$3.00

FREE TO MEMBERS AND ASSOCIATE MEMBERS OF THE MUSEUM

SINGLE COPIES 50 CENTS

The American Museum of Natural History

Board of Trustees

HENRY FAIRFIELD OSBORN, President
CLEVELAND H. DODGE, First Vice President
J. P. MORGAN, Second Vice President
GEORGE F. BAKER, Jr., Treasurer
PERCY R. PYNE, Secretary
GEORGE F. BAKER
FREDERICK F. BREWSTER
FREDERICK TRUBEE DAVISON
CLEVELAND EARL DODGE
WALTER DOUGLAS
CHILDS FRICK
MADISON GRANT

WILLIAM AVERELL HARRIMAN
ARCHER M. HUNTINGTON
ADRIAN ISELIN
ARTHUR CURTISS JAMES
WALTER B. JAMES
OGDEN MILLS
A. PERRY OSBORN
GEORGE D. PRATT
THEODORE ROOSEVELT
LEONARD C. SANFORD
JOHN B. TREVOR
FELIX M. WARBURG

JOHN F. HYLAN, MAYOR OF THE CITY OF NEW YORK
CHARLES L. CRAIG, COMPTROLLER OF THE CITY OF NEW YORK
FRANCIS D. GALLATIN, COMMISSIONER OF THE DEPARTMENT OF PARKS

GEORGE H. SHERWOOD, Executive Secretary

Scientific Staff

FREDERIC A. LUCAS, Sc.D., Director
ROBERT C. MURPHY, Assistant to the Director (in Scientific Correspondence, Exhibition, and Labeling)
JAMES L. CLARK, Assistant to the Director (in Full Charge of Preparation)

DIVISION OF MINERALOGY AND GEOLOGY W. D. MATTHEW, F.R.S., Curator-in-Chief

Geology and Invertebrate Paleontology
EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Associate Curator of Invertebrate Paleontology
CHARLES P. BERKEY, Ph.D., Research Associate in Geology

Mammalogy
ROY C. ANDREWS, A.M., Associate Curator of Mammals of the Eastern Hemisphere
H. E. ANTHONY, A.M., Associate Curator of Mammals of the Western Hemisphere
HERBERT LANG, Assistant Curator, African Mammals
CARL E. ACELEY, Associate in Mammalogy

Mineralogy
HERBERT P. WHITLOCK, C.E., Curator
GEORGE F. KUNZ, Ph.D., Research Associate, Gems

Comparative Anatomy
WILLIAM K. GREGORY, Ph.D., Curator
S. H. CHUBB, Assistant Curator
J. HOWARD McGREGOR, Ph.D., Research Associate in Human Anatomy

Vertebrate Paleontology
HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Honorary Curator
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Associate Curator of Fossil Mammals
BARNUM BROWN, A.B., Associate Curator of Fossil Reptiles
CHARLES C. MOOK, Ph.D., Associate Curator
WILLIAM K. GREGORY, Ph.D., Associate in Palaeontology
CHILDS FRICK, B.S., Research Associate in Palaeontology

DIVISION OF ANTHROPOLOGY
CLARK WISSLER, Ph.D., Curator-in-Chief
Anthropology
CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator in Ethnology
N. C. NELSON, M.L., Associate Curator of Archaeology
CHARLES W. MEAD, Assistant Curator of Peruvian Archaeology
LOUIS R. SULLIVAN, Ph.D., Assistant Curator, Physical Anthropology
CLARENCE L. HAY, A.M., Research Associate in Mexican and Central American Archaeology
MILTON HELLMAN, D.S., Research Associate in Physical Anthropology

DIVISION OF ZOOLOGY AND ZOÖGEOGRAPHY FRANK MICHLER CHAPMAN, N.A.S., Curator-in-Chief

Lower Invertebrates
ROY W. MINER, Ph.D., Curator
WILLARD G. VAN NAME, Ph.D., Assistant Curator
FRANK J. MYERS, Research Associate, Rotifera
HORACE W. STUNKARD, Ph.D., Research Associate, Parasitology
A. L. TREADWELL, Ph.D., Research Associate, Annulata

Comparative Physiology
RALPH W. TOWER, Ph.D., Curator
Comparative Anatomy
WILLIAM K. GREGORY, Ph.D., Curator
J. HOWARD McGREGOR, Ph.D., Research Associate in Human Anatomy

Entomology
FRANK E. LUTZ, Ph.D., Curator
A. J. MUTHLER, Assistant Curator in Coleoptera
FRANK E. WATSON, B.S., Assistant in Lepidoptera
WILLIAM M. WHEELER, Ph.D., Research Associate, Social Insects
CHARLES W. LENG, B.S., Research Associate, Coleoptera
HERBERT F. SCHWARZ, A.M., Research Associate, Hymenoptera

DIVISION OF EDUCATION AND PUBLICATION

GEORGE H. SHERWOOD, A.M., Curator-in-Chief

Library and Publications
RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Assistant Librarian

Public Education
GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Associate Curator
RUTH CROSBY NOBLE, B.A., Assistant Curator
GRACE FISHER RAMSEY, Assistant Curator

Public Health
CHARLES-EDWARD AMORY WINSLOW, D.P.H., Honorary Curator
MARY GREIG, Assistant

Natural History Magazine
HERBERT F. SCHWARZ, A.M., Editor
A. KATHERINE BERGER, Assistant Editor

ADVISORY COMMITTEE

FREDERIC A. LUCAS, Sc.D., Director
ROBERT C. MURPHY, Ph.D., Assistant to the Director
FRANK M. CHAPMAN, Sc.D., Curator-in-Chief, Division of Zoölogy and Zoogeography
W. D. MATTHEW, Ph.D., Curator-in-Chief, Division of Mineralogy and Geology

Ichthyology
BASHFORD DEAN, Ph.D., Honorary Curator
JOHN T. NICHOLS, A.B., Associate Curator in Recent Fishes
E. W. GUDGER, Ph.D., Associate in Ichthyology

Herpetology

G. KINGSLEY NOBLE, Ph.D., Associate Curator (In Charge)
ARTHUR I. ORTENBURGER, M.S., Assistant Curator

Ornithology

FRANK M. CHAPMAN, Sc.D., Curator
W. DEW MILLER, Associate Curator
ROBERT CUSHMIRE MURPHY, D.Sc., Associate Curator of Marine Birds
JAMES P. CHAPIN, A.M., Associate Curator, Birds of the Eastern Hemisphere
LUDLOW GRISCOM, M.A., Assistant Curator
JONATHAN DWIGHT, M.D., Research Associate in North American Ornithology
MRS. ELSIE M. B. R. Naumburg, Research Assistant

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY,
EXPLORATION, AND THE DEVELOP-
MENT OF PUBLIC EDUCATION
THROUGH THE MUSEUM



MAY-JUNE, 1923

[Published June, 1923]

VOLUME XXIII, NUMBER 3

Copyright, 1923, by The American Museum of Natural History, New York, N. Y.

NATURAL HISTORY

VOLUME XXIII

CONTENTS FOR MAY-JUNE

NUMBER 3

Frontispiece, Restoration of the Tree-browsing Baluchitheres of Central Asia.....	208
From a crayon drawing made by Mrs. E. Rungius Fulda, under the direction of Prof. Henry Fairfield Osborn	
The Extinct Giant Rhinoceros <i>Baluchitherium</i> of Western and Central Asia	208
HENRY FAIRFIELD OSBORN	
The largest rhinoceros of all time—probably the largest of terrestrial mammals—compared with other rhinoceroses, living and extinct.	
Illustrated by portraits, uniform in scale, of these animals by such artists as Charles R. Knight, Mrs. E. Rungius Fulda, Mrs. L. M. Sterling, and Philip L. Sclater, as well as by photographs taken in the field by Mr. Herbert Lang and Mr. Jenness Richardson.	
Some Bird Voices of the Northern Woods.....	CHARLES MACNAMARA 229
Songs and calls of the feathered visitors to Arnprior, Ontario, Canada	
With photographs of the region and of its birds	
Nature and Human Nature in a Probationary Classroom	239
LUCY CLARKE SIMONSON	
The inspirational value of nature teaching in remolding young lives	
Man as a Museum Subject.....	CLARK WISSLER 244
Landmarks in the development of the department of anthropology, American Museum	
With pictures indicating the scope of its activities and its accomplishments	
The Buried Past of Mexico.....	CLARENCE L. HAY 258
Opportunities for archeological work in the central and northern parts of the republic	
Photographs of sites and excavated objects supplied by Dr. Manuel Gamio, Mrs. Zelia Nuttall, Dr. A. V. Kidder, the Museum of the American Indian—Heye Foundation, etc.	
Monkeys Trained as Harvesters.....	E. W. GUDGER 272
Instances of a practice extending from remote times to the present	
With pictorial records from the tombs of Egypt and from present-day Java	
The Buffalo Drive and an Old-World Hunting Practice ..	ROBERT H. LOWIE 280
A cultural parallel between the Lapps and the North American Indians	
Illustrated	
The Natives of South Africa.....	ROBERT BROOM 283
The ancient and surviving races of this area	
Photographs of characteristic types by A. M. Cronin	
Jumping "Seeds".....	FRANK A. LEACH 295
Plant growths that hop about like fleas	
Illustrated	
Notes.....	301

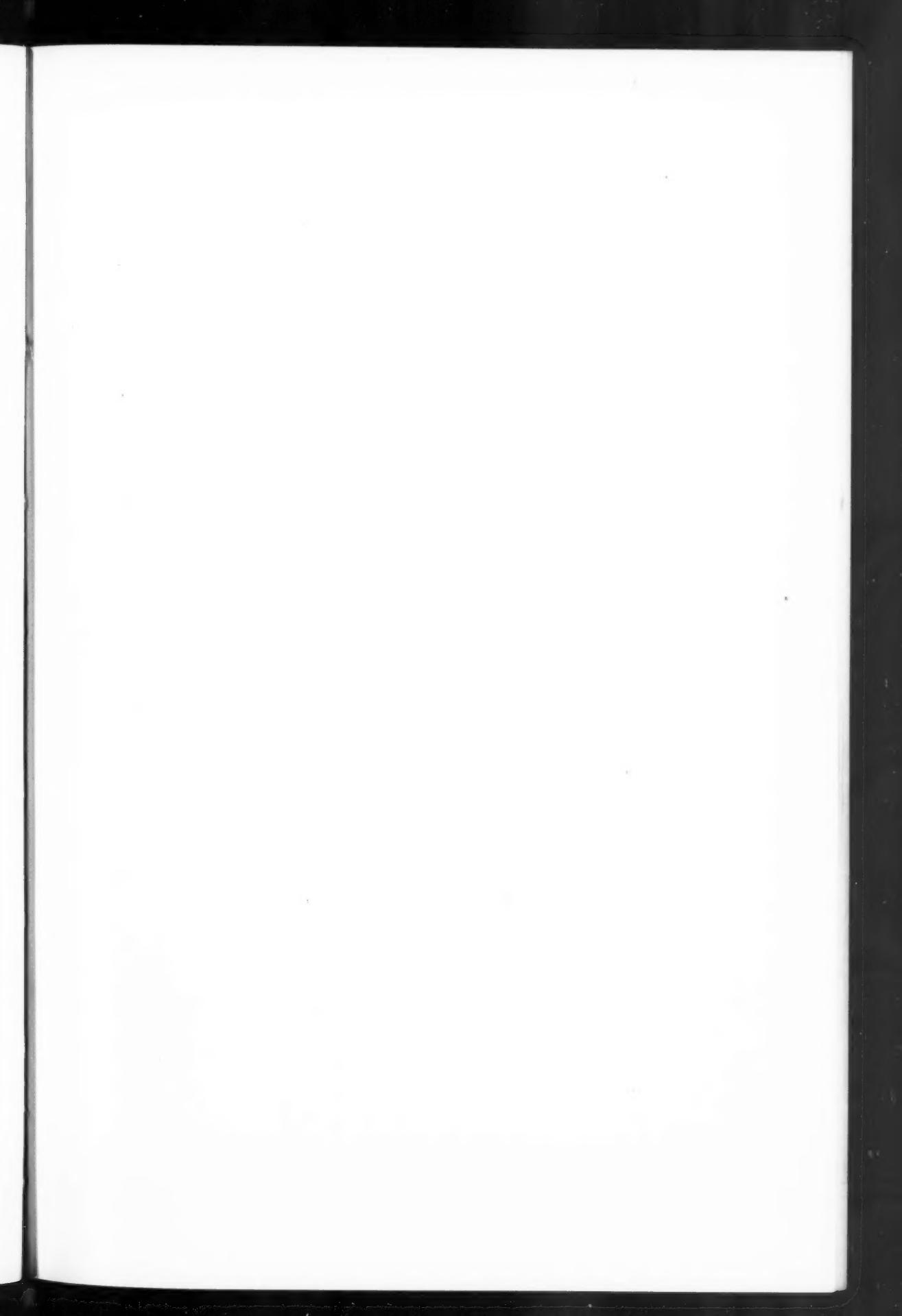
Published bimonthly, by the American Museum of Natural History, New York, N. Y.
Subscription price \$3.00 a year.

Subscriptions should be addressed to George F. Baker, Jr., Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York City.

NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership.

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.



RESTORATION OF THE TREE-BROWSING BALUCHITHERES OF WESTERN AND CENTRAL ASIA

Drawn, under the direction of the writer, by E. Rungius Filds, April, 1923

2018



NATURAL HISTORY

VOLUME XXIII

MAY-JUNE

NUMBER 3

The Extinct Giant Rhinoceros *Baluchitherium* of Western and Central Asia

THE LARGEST RHINOCEROS OF ALL TIME—PROBABLY THE LARGEST OF TERRESTRIAL MAMMALS—COMPARED WITH OTHER RHINOCEROSES, LIVING AND EXTINCT

By HENRY FAIRFIELD OSBORN

President of the American Museum of Natural History

This remarkable animal was first found near Chur-lando, Baluchistan, by the Cambridge University explorer and paleontologist, C. Forster Cooper, and described by him December, 1911; it was given the generic name *Baluchitherium*, to commemorate the region where it was discovered, and the specific name *osborni*, in honor of the writer of the present article. The second discovery was made near Turgai, a province of north Turkestan, by the Russian paleontologist, A. Borissiak, and named *Indricotherium asiaticum* in 1916. Neither discovery included the skull, although parts of the teeth were found, indicating an affinity to the rhinoceroses. The third discovery, revealing for the first time the creature's skull, was made in central Mongolia, by the Third Asiatic Expedition, which the American Museum is conducting in coöperation with the American Asiatic Society and with *Asia* and of which Mr. Roy Chapman Andrews is the leader. This find was named *Baluchitherium grangeri*, in honor of Walter Granger, the chief paleontologist of the expedition.

It is necessary to open this article with a brief outline of what we have previously known of the history of the horned and hornless rhinoceroses of the world, for without such an introduction we cannot give *Baluchitherium* its true setting among the great group of quadrupeds which originally derived its family name from the earliest rhinoceros known to the savants of western Europe, namely, the *Rhinoceros unicornis* of India.

The Greek word rhinoceros is derived from *rhino* (*ρίνος*), nose, and *keras* (*κέρας*), horn, to which was added the Latin specific name *unicornis*, signifying jointly the animal which bears a single horn on the nasal region of the skull. This unicorn-rhinoceros—famous in the history of zoölogy, in animal mythology, where it appears as the unicorn, as well as in the history of medicine throughout the Middle Ages because the horn was supposed to have peculiar medicinal virtues¹—was long

believed to be the only rhinoceros in the world. But when Africa was opened up to explorers, the 'black' rhinoceros was discovered with its two horns, namely, a nasal and a median, and naturally was described in 1758 as *Rhinoceros bicornis*, signifying the two-horned rhinoceros. This discovery was followed in 1817 by the description of the giant 'white' rhinoceros of Africa, distinguished by its lighter grayish color from the black rhinoceros. To this 'gray-white' rhino the name *Rhinoceros simus* was given, the Latin-Greek specific name (Latin = *simus*, Greek = *σιμός*) signifying the flat-nosed or snub-nosed rhinoceros, in reference to the very broad snout adapted to grazing, quite different from the narrow and pointed snout of the black rhinoceros, which is adapted to browsing.

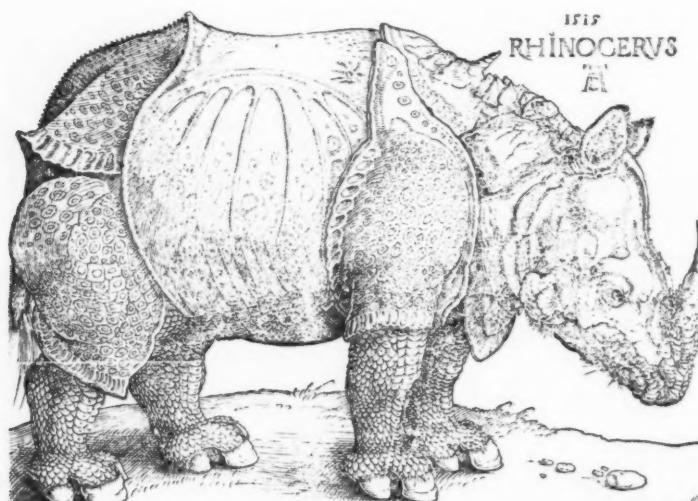
Long before this, however, fossil rhinoceroses began to be found. First came the discovery of the great *Rhinoceros antiquitatis*, so named by Blumenbach in 1799; this is the 'woolly' rhinoceros of the northern tundras of the

¹See the article entitled "The Unicorn and His Horn," by Frederic A. Lucas, NATURAL HISTORY, Vol. XX, November-December, 1922, pp. 532-35.

Ice Age, a companion to the 'woolly' mammoth (*Elephas primigenius*), also named by Blumenbach. All of these living and fossil rhinoceroses, discovered in Asia, Africa, Siberia, and various parts of western Europe, were distinguished by the presence of either one or two horns, varying in proportions and culminating in the gigantic single-horned *Elasmotherium sibiricum*

and the gray-white rhinoceros. Gray was the first (1867) to apply to the white rhinoceros the distinct generic name *Ceratotherium*.

Naturalists then began to be impressed with the differences in the cutting teeth of the rhinoceroses, which were composed not of *canine* tusks as in other quadrupeds, but of an enlarged pair of upper and lower incisor teeth,



After an etching of the "Rhinocerus" by Albrecht Dürer, dated 1515, presented to the American Museum by Dr. Bashford Dean. Comparing this remarkable etching with Philip Lutley Sclater's drawing of the *Rhinoceros unicornis* reproduced on page 219, we observe that Dürer has interpreted the dermal armature of the Indian rhinoceros in terms of the ornamented steel armor of the age of chivalry

in which the horn was borne not on the nasals but on the middle of the top of the skull.

Thus a great variety of generic names was successively applied, referring to horns of different kinds, as follows: *Dicerorhinus* Gloger (1841) and *Ceratorhinus* Gray (1867) to the primitive two-horned rhinoceros discovered in Sumatra; *Diceros* Gray (1821) to the two-horned black rhinoceros of Africa; and *Opsiceros* Gloger (1841) to both the African black rhinoceros (type)

namely, the *second incisor* above and the *second incisor* below, corresponding with the tusks in the elephant family which are also second incisors above and below and not canines as would at first appear. Consequently naturalists began to distinguish the rhinoceroses by the presence or absence of their cutting teeth: for example, rhinoceroses without cutting teeth were all placed in the genus *Atelodus*, proposed by Pomel in 1853; the thick-jawed rhinoceros of Greece was named

Colodus, and the large-toothed rhinoceros of Archer, Florida, was named *Eusyodon* by Leidy.

All together between 1758, when Linnaeus made the Indian rhinoceros the type of his genus *Rhinoceros*, and 1904, the year of the publication of Palmer's great *Index Generum Mammalium* (Index to the Genera of Mammals), not less than 42 generic names were proposed for the various kinds of rhinoceroses, many receiving several generic names which became synonyms of one another. Up to and including the years 1897–1905, when Trouessart's great *Catalogus Mammalium tam Viventium quam Fossilium* was written, upwards of 170 species of rhinoceroses, living and fossil, had been described.

HORNLESS RHINOCEROSES DISCOVERED, 1832–1911

Naturalists became so accustomed to the idea of one or two horns as a universal characteristic of the rhinoceros family, that in the year 1832 there came as a complete surprise the discovery of a skull near Eppelsheim in the vicinity of Darmstadt, Germany, of what was supposed to be a *hornless* rhinoceros. To this specimen the paleontologist Kaup gave the generic name of *Aceratherium*, signifying a rhinoceros without horns, the absence of horns being compensated for by a pair of strongly offensive upper and lower incisive tusks, to which the specific name *incisivum* refers; hence Kaup's animal was considered a hornless rhinoceros with incisive tusks. The writer's own observations, made during the year 1898 on this same specimen, are detailed below.

The timeliness of recalling Kaup's discovery at the present moment is that the great *Baluchitherium* also proves to be a hornless rhinoceros with very powerful incisive tusks, and at

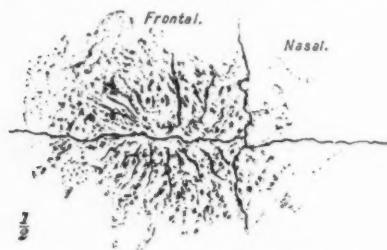
once the question arises as to its relationship to the *Aceratherium incisivum* of Kaup. In considering this question, we must first realize that *Baluchitherium grangeri* is of Oligocene or of Miocene age and is thus geologically more ancient than Kaup's *Aceratherium incisivum*, which is of Lower Pliocene age. Obviously *Baluchitherium* cannot be a descendant of *Aceratherium*, and with that possibility eliminated, another alternative suggests itself: whether it may not be a gigantic ancestor from which the Pliocene *Aceratherium* descended. We shall see that this conjecture must be answered with a decided negative, because *Baluchitherium* belongs to a distinct breed or line of hornless rhinoceroses, a line of evolution now made known for the first time by a series of discoveries beginning in 1911.

SEVEN DISTINCT LINES OF RHINOCEROSES, HORNED AND HORNLESS, RECOGNIZED BEFORE BALUCHITHERIUM WAS DISCOVERED

All the herbivorous quadrupeds tend to spread and migrate into different habitats and climates and into new feeding grounds of various kinds to which they become fitted through a principle of evolution which the writer has called *adaptive radiation*. The seven lines of rhinoceroses separated from each other at a very ancient period, and although externally similar in certain cases, they are really very far apart in their history and anatomy; even the two living African rhinoceroses probably separated from each other a million years ago. Thus the original genus *Rhinoceros* now includes numerous distinct branches of the great rhinoceros family.

During the years 1893–1905 the present writer was actively engaged in

the study of the living and extinct rhinoceroses of various parts of the world. At the time the multiplicity of 42 generic and upwards of 170 specific names was terrifying; it indicated an almost hopeless confusion in the minds of naturalists regarding the real relationships and affinities of these remarkable animals. There certainly could not be 42 different genera of rhinoceroses; the majority of these names must be synonyms. Nor was it likely that there could be 170 different species of rhinoceroses, highly varied as these animals were known to be in various stages of evolution. What key



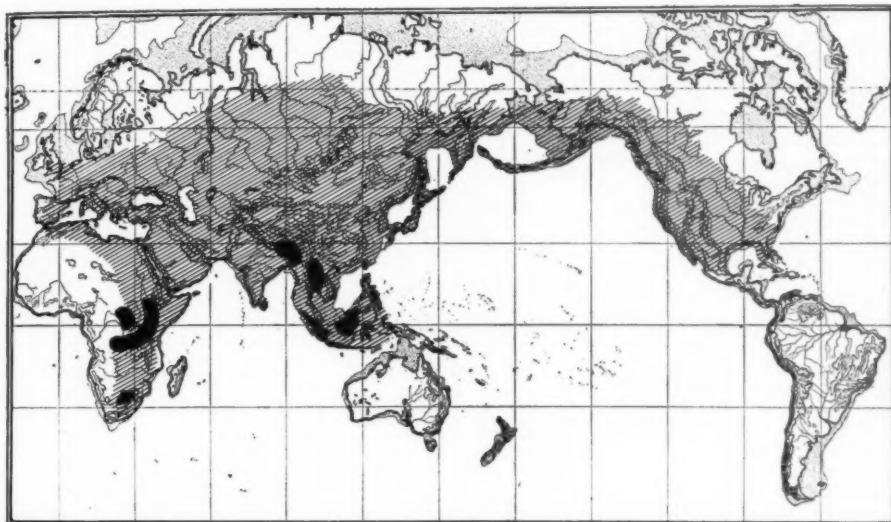
After the author's sketch of the horn rugosity at the union of the frontal and nasal bones of *Aceratherium incisivum*. Sketch made at Darmstadt Museum, August, 1900.

could be found to this labyrinthine maze of names? The mode of search for such a key was indicated in the preface of the author's Memoir entitled *The Extinct Rhinoceroses*, published by the American Museum in 1898, namely, to arrive at a sound basis of classification for the anatomy and evolution of the rhinoceroses, derived from a comparison of their most primitive forms, according to the geologic period of their origin, and from a study of the characters in which various lines of rhinoceroses parallel or imitate each other, in contrast to those divergent characters in which they actually separate from each other in habits

and habitat; thus laying the foundation of a true interpretation of their ancestral history.

In order to carry out this purpose, which the writer formulated during his study of the very primitive rhinoceroses of North America discovered in the course of the American Museum expeditions that were conducted between the years 1890-98, the writer made a journey during the summers of 1898 and 1900 through all the great natural history museums of Europe,—London, Paris, Lyons, Munich, Darmstadt, Stuttgart, Augsburg, Vienna, St. Petersburg, and Moscow, where the principal types of fossil and living rhinoceroses described by the great palaeontologists and zoölogists of Europe could be found, namely, the types of Blumenbach, of Cuvier, of Duvernoy, of Kaup, of Bronn, of Gaudry, and of other authors too numerous to mention.

In some instances these specimens were thickly covered with dust. In the ancient Museum of Darmstadt, for example, lay Kaup's classic type of *Aceratherium incisivum* on a shelf accumulating the dust of decades. The aged conservator was horror-stricken when a young American palaeontologist appeared requesting the privilege of examining this venerable specimen more closely and only through a rather vigorous appeal to the distinguished geologist, Professor Richard Lepsius, did the writer succeed in having this ancient specimen brought out and placed on a table. By blowing upon it a few times and applying a duster the deposit of dust was removed, and, *presto*, the writer made a most interesting discovery which had completely escaped the learned eye of Professor Kaup in 1832, i.e., that this type skull bears indubitable proof of the presence



Rhinoceroses still survive only in the areas indicated in solid black on this map, namely, two species in Africa and three species in Asia. The oblique-line shading indicates the probable former range of these animals, including all the continents except Australia and South America. In North America the rhinoceros did not invade Mexico (in this respect the map is erroneous), but in Middle Miocene times it reached the eastern coast of Maryland, the Carolinas, and Florida.

of a little horn right in the middle of its forehead, as shown in the accompanying sketch made by the writer before the eyes of the astonished curator, and that the name *Aceratherium*, or hornless, is therefore a misnomer. Thereupon, encouraged by this discovery, the dust was removed everywhere; rusty locks were opened; ancient trays filled with dust-covered specimens were taken down from the shelves. At times there were picturesque occurrences,—for instance in the Imperial Museum of Moscow, where the head curator appeared in an ornate uniform to welcome the writer. As a rule, however, the work was hard and prosaic, requiring rapidly executed pencil sketches and volumes of notes, drawings, and memoranda; but the sequel was highly satisfactory. It was expressed in the writer's rhinoceros article entitled "Phylogeny of the Rhinoceroses of Europe," published as

a *Bulletin* of the American Museum, December 11, 1900, in which the following conclusion was reached: that the true rhinoceroses of the Age of Mammals and of modern times belong in at least six great and distinct lines of descent and of evolution, which have been separated from each other since very early geologic times and from which lesser branches have been given off. The eight great lines now known are as follows:

I. Primitive hornless *ACERATHERES* of western Europe and North America, entirely hornless or with rudiments of horns on the forehead.

II. Primitive two-horned *DICERATHERES*, in which two little horns are placed side by side at the front of the nasals instead of tandemwise. These animals range from western Europe to North America.

III. Short-footed rhinoceroses, *BRACHYPODINES*, with a body shape like that of hippopotami, and a sharp, wedge-shaped horn at the very tip of the nasals. These migrated from western Europe to the southern United States.

IV. Tandem-horned rhinoceroses, CERATORHINES, chiefly of southern Asia and southern Europe, surviving in the Sumatran rhinoceros, now living in the forests of Sumatra; never finding their way to North America.

V. Typical rhinoceroses of India, RHINOCEROTINES, with a single anterior horn, *Rhinoceros indicus*, and its relative, *R. sondaicus*, and fossil ancestors.

VI. Rhinoceroses without cutting teeth, ATELODINES, of Africa, including the hook-lipped browsing *Diceros bicornis*, the broad-lipped grazing *Ceratotherium simum*, and fossil ancestors.

VII. ELASMOOTHERES, or gigantic rhinoceroses of the tundras of northern Europe and Asia, with a single huge horn in the middle of the forehead.

VIII. BALUCHITHERES (Baluchitheriinae), gigantic hornless rhinoceroses of the early Tertiary or Oligocene age of Asia, resembling the ACERATHERES but with stilted limbs attaining colossal height.

I. THE PRIMITIVE HORNLESS RHINOCEROSES, OR ACERATHERES

The Aceratheres are the simplest rhinoceroses known, appearing early in the Age of Mammals. They are found in southern Europe, southern Asia, and in our own western states, Colorado and South Dakota. At first they were no larger than tapirs, with perfectly smooth skull top devoid of a rudiment or sign of a horn either on the nasal or the frontal bones—thus typical Aceratheres. Undoubtedly the true Eocene ancestors of these animals still await discovery; we may come across them in Asia. Although there are animals very close to the ancestral rhinoceros stage among the varieties of the quadruped known as *Hyrachys*, found near Fort Bridger in southwestern Wyoming, we are inclined to believe that North America was not the homeland of the rhinoceroses.

The first animal of this kind found in our western states was brought to Dr. Joseph Leidy of Philadelphia, the

founder of mammalian palaeontology in America; he recognized at once its general resemblance to the *Aceratherium* of Kaup (1832) and described it as *Aceratherium occidentale*, or the Acerathere of the West. Quite recently there were found in Colorado the fossil remains of a little herd of Aceratheres characterized by even more primitive structure and known as *Trigonias* from an upper jaw that had been described by Lucas in 1900. The name had been given because of the presence of triangular cutting teeth at each angle of the jaw, for these little animals possessed small upper canine tusks or eyeteeth, also third upper incisors, as well as second upper incisors, which were beginning to be enlarged to press against the tusklike lower incisor teeth. Another distinction of these animals was the possession of four digits on the front foot, unlike the living rhinoceros, which has only three, hence their specific name *tetradactylum*, signifying four-toed.

These Aceratheres were not only very numerous but very hardy, well protected from their enemies and vigorous. In Lower Oligocene times they ranged widely over the whole Northern Hemisphere, both in North America and Eurasia, including India. They branched out into several varieties of descendants, which culminated in Europe in the *Aceratherium incisivum* of the Lower Pliocene of Germany. In North America they survived into Middle Pliocene times, being represented by the *Aphelops megalodus*, the hornless and big-toothed Acerathere of western Colorado described by Cope in 1873, and also by the very long-limbed *Aphelops malarcorhinus* of Cope, the hornless, soft-nosed Acerathere, and finally by the long-footed one, discovered by Leidy

in Florida and described in 1890 under the specific name *longipes*.

These Miocene and Lower Pliocene Aceratheres were almost as large as the existing Indian rhinoceroses. As a rule they were everywhere distinguished by very powerful lower incisor tusks, splendid fighting weapons; also by long limbs whereby they were able to run swiftly and thus escape their enemies; the snout was either abso-

semble the Aceratheres in their long limbs, their relatively slender bodies, well raised off the ground, and their strongly offensive and defensive lower incisor tusks; they are of the size of tapirs and capable of rapid motion. They appear to differ, however, from the outset in two important characters: they have only three digits on the fore foot instead of the four found in the true Aceratheres; but still more im-



Typical Diceratheres of South Dakota, named *Diceratherium tridactylum*. The animals were drawn from a perfect skeleton discovered in 1892 and now in the American Museum. At this stage of evolution the horn rudiments were extremely slight; they appeared as paired rugosities on the nasal bones, and are observed only in old male specimens. These rugose areas are somewhat like the corresponding area shown in the sketch on page 212. Hence this animal was first regarded as an Acerathere by Osborn, but later proved to be an ancestor of the true pair-horned Diceratheres.

lutely smooth or, yielding to the rhinocerotine tendency, had nasal horn rudiments. Yet the forehead or median horn rudiment, as observed in the *Aceratherium incisivum* of Kaup, is also present in some of the American Aceratheres.

II. THE PAIR-HORNED RHINOCEROSES, OR DICERATHERES, OF EUROPE AND OF WESTERN NORTH AMERICA

The Diceratheres, like the Aceratheres, are very primitive and ancient, namely, of the Oligocene of France and of South Dakota. They closely re-

portant and characteristic is the position of the horns, which appear side by side on the top of the nasals instead of in the tandem arrangement peculiar to all other horned rhinoceroses.

The Diceratheres, therefore, are readily remembered as the pair-horned rhinoceroses. They too are great travelers, being very abundant in central France and in the Rocky Mountain region of South Dakota; from the latter locality superb specimens were described by Osborn in 1893 under the specific name *tridactylum* in contradistinction to *tetradactylum*. These

animals were found by the American Museum expedition in beds of Upper Oligocene age, and the paired horns were so rudimentary that it was not at first recognized that they were true Diceratheres, directly ancestral to the species *Diceratherium annectens*, i.e., the annectent Dicerathere, which had been described by Marsh from the John Day valley of Oregon in 1873, or to *Diceratherium armatum*, the well-armed Dicerathere, so named by Marsh in 1875, from the same region of Oregon. Professor Marsh was thus the first to set apart the pair-horned Diceratheres from all other rhinoceroses. The French palaeontologists, Aymard, Filhol, and Duvernoy, hesitated to separate these pair-horned rhinoceroses, which they found very abundant in Upper Oligocene strata in France and in Germany, although Duvernoy named one of his specimens *Rhinoceros pleuroceros*, signifying that the horns were borne side by side. These animals do not appear to have been quite so vigorous or successful in their migrations and combats as the Aceratheres, although they are traced into the Lower Miocene near Orléans, namely, the *sables de l'Orléanais* of central France; and are perhaps even present in Baluchistan, where they are reported from beds in the Bugti Hills although this discovery awaits confirmation.

So far as we know, the Diceratheres died out in Lower Miocene times, whereas the Aceratheres persisted into Middle Pliocene times both in America and Eurasia.

III. THE SHORT-FOOTED RHINOCEROSES, BRACHYPODINES

In wide contrast to the cursorial and swift-traveling Aceratheres and Diceratheres, there appeared in Lower Mi-

cene times in France, contemporary with one species of the Diceratheres, in the same river deposit now known as the *sables de l'Orléanais*, an animal first described by the French palaeontologist Nouel as *Rhinoceros aurelianensis*, the rhinoceros of Orléans. This medium-sized rhino is the earliest known progenitor of one of the most extraordinary groups of rhinoceroses the world has known; extraordinary because, despite their excessively short limbs and feet to which the name *brachypodine* refers, and their low heavy bodies, probably adapted like that of the hippo to living along river borders, water courses, and in swampy lowlands, they traveled over the entire Northern Hemisphere in great herds, absolutely protected against their enemies by a very sharp pair of lower cutting tusks, which resemble those of the Aceratheres and of the Diceratheres, as well as by a very sharp, narrow, wedge-shaped horn placed on the very tip of the nasal bone. With this double protection and probably a very thick skin, they defied the Carnivora.

We find them in southern France in great numbers, in the quarries of the Island of Samos of the eastern Mediterranean, in the quarries of Maragha, Persia, in the Siwalik floodplain deposits of India, in the East Indies, and in Japan,—always migrating eastward. Finally they enter northern Asia, cross the Asiatic-American land bridge, reach North America, and, in Lower Pleistocene times, they not only spread over our western states as far south as Kansas, but penetrate even to Florida! Finally a great herd of these animals was discovered in 1883 in a quarry near Long Island, Phillips County, Kansas, by the veteran collector Charles Sternberg. This

wonderful quarry yielded rich collections to the University of Kansas, to the Museum of Comparative Zoölogy in Cambridge, to the United States National Museum, and to the American Museum.

These animals, as first discovered in the Upper Miocene of France, received the specific name of *brachypus*, signifying the short-footed rhinoceroses; as

partly aquatic in its habits, with a very large brain and no diploë or spongy lining to the skull. The limbs were far shorter than those of any living type of rhinoceros. In the females the nasals bore a very small horn; in the males, especially as found in the Lower Pliocene of the Republican River, Nebraska, the nasals became greatly thickened at the extremities into a



The short-footed or brachypodine rhinoceros, known as *Teleoceras fossiger*, as it appeared in Lower Pliocene times in the locality now known as Long Island, Kansas. After a painting by Charles R. Knight, made in 1898 under the direction of the author. This animal was almost certainly aquatic in its habits, and in a revised restoration it will be shown without the skin folds. It will then have more of the smooth, rounded appearance of the hippopotamus

found in the Lower Pliocene of Germany, they were given the specific name of *goldfussi*, after one of the German palaeontologists. Later the American palaeontologist Hatcher applied to them the generic name *Teleoceras*, signifying the end horn rhinoceros. From the collection, already referred to, that was obtained at Long Island, Kansas, Osborn in 1898 described *Teleoceras* as a broad-headed, extremely short-limbed rhinoceros,

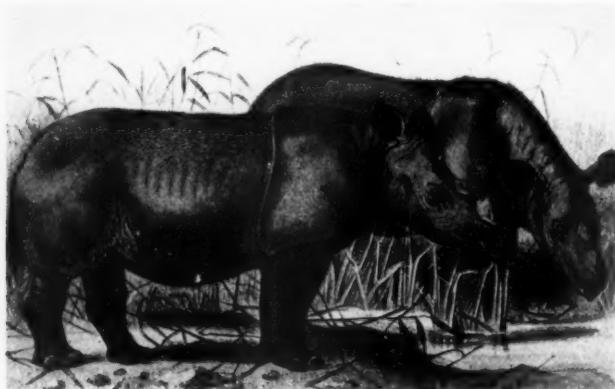
vertically compressed plate which bore a tall, thin, wedge-shaped horn. The body proportions were 10 feet in length, with a height at the withers of only a little over 4 feet, and with a girth of the abdomen at the ribs of 9 feet 2 inches. It was on the mounted skeleton from this same Long Island quarry that Charles R. Knight in 1898 based the beautiful restoration of *Teleoceras* that he drew under the direction of the writer, as shown in the accompanying illustration.

IV. THE TANDEM-HORNED RHINOCEROSES, CERATORHINES, NOW SURVIVING IN SUMATRA, EASTERN BENGAL AND ASSAM

Unlike the tandem-horned rhinoceroses of Africa, which have no cutting teeth, these animals retain small cutting incisor tusks, supplemented by a pair of relatively small but very effective horns.

In a little fossil-bearing hill near Sansan (Gers), France, Lartet in 1848 discovered the diminutive animal which he called the rhinoceros of San-

known as *Rhinoceros steinheimensis*, found in the Upper Miocene of Steinheim, Westphalia, Prussia, assume a little larger size; they appear somewhat larger still in the race known as Schleiermach's rhinoceros of the Lower Pliocene of Eppelsheim. Their first appearance in southern Asia is in the 'flat-nosed' rhinoceros, *Rhinoceros platyrhinus*, of the Lower Pleistocene deposits of India. Like all rhinoceroses these animals were first described as belonging to the genus *Rhinoceros*, but



This is the two-horned, hairy-eared rhinoceros of eastern Bengal, known as *Rhinoceros lasiotis*. Its tandem horns clearly distinguish it from the unicorn rhinoceros of Nepal and relate it to the rhinoceros of Sumatra. It is now very rare

san, the *Rhinoceros sansaniensis* of his "Notice sur la Colline de Sansan." Shortly afterwards, in the neighboring and somewhat more recent deposit of Simorre, he found the related rhinoceros of Simorre, i.e., *Rhinoceros simorrensis*, a diminutive tandem-horned rhinoceros of such slender proportions that Jourdan gave it the specific name of *elegans*. These tandem-horned animals were defended by a horn in the center of the nasals and a smaller horn in the center of the forehead. As first found in the Middle Miocene of France, they are small and of slender proportions, hardly larger than tapirs; those

they really were profoundly different from the Indian Rhinoceros, to which alone the generic name *Rhinoceros* properly applies. As observed in Sumatra, they are persistently primitive animals, and probably inhabited during the geologic past, as they still do at present, the deep recesses of forests. Such protected environment is never favorable to rapid evolution but rather to persistence of type: for example, the forest-living okapi of central Africa today is far more primitive than its remote relative, the plains-living giraffe, which is exposed to enemies on every side.

These forest-living Ceratorhines were nevertheless widely distributed in past time: they were quite abundant in central India, the present region of the Siwalik Hills, in late Pliocene or early Pleistocene times, and we trace them westward again along the north shores of the Mediterranean in the slender-nosed Ceratorhine (*Ceratorhinus leptorhinus*), which is represented by numerous remains from near Montpellier (Hérault), France. There is

article, namely, to the typical Asiatic rhinoceros, *R. unicornis*, a very powerful animal which is nearing extinction, but still survives in the forests of Nepal in northern India, where the Faunthorpe Expedition has recently secured a fine group for the American Museum. A related form occurs in the Islands of the East Indies in the species *R. sondaicus*. No representatives of these true Indian rhinoceroses have ever been found in Europe, or in



This beautiful drawing of the Asiatic rhinoceros, *Rhinoceros unicornis*, which appeared in Philip Lutley Selater's Memoir of 1875 on the rhinoceroses, exhibits the broadly overlapping dermal folds which completely protect this animal from its enemies, a defensive adaptation interpreted by Albrecht Dürer in 1515 as shown on page 210.

also the long, slender-limbed Etruscan Ceratorhine (*C. etruscus*) from the Upper Pliocene, a geologic period when these animals, favored by a genial climate, occurred in the very broad forest belt extending from the east coast of England, where they are abundant in the Upper Pliocene Red and Norwich Crags, southward and eastward across southern France and northern Italy to distant India.

V. THE TYPICAL SINGLE-HORNED RHINOCEROSES OF ASIA

The consideration of the fifth group brings us back to the beginning of this

Africa, or in the remote parts of the East Indies, or in fact anywhere except in southern Asia; none of them ever came over to North America; they appear to be exclusively Asiatic in their distribution.

The past geologic history of the true Indian rhinoceroses is rather obscure, for they are not found in any of the more ancient fossil beds of the Siwaliks, India, but appear with relative suddenness near the summit of the Siwaliks in the form of two species known as *R. sivalensis*, the rhinoceros of the Siwaliks, and *R. palaeindicus*, the ancient rhinoceros of India. Of the two surviv-



(Left) Front view of the square-lipped 'white' grazing rhinoceros of the Lado district, Africa. After photograph by Herbert Lang



(Right) Side view of the pointed-lipped 'black' rhinoceros, a browser of the central African plateau. After photograph by Jenness Richardson

ing species the giant animal or typical *Rhinoceros unicornis*, with its longer crowned grinding teeth, is a *grazer*, preferring the grassy savannas of Nepal, whereas the smaller rhinoceros of India, known as *R. sondaicus*, is



White rhinoceros skull in the American Museum, brought to England by a missionary, the Rev. John Campbell, in the year 1815; preserved in the Museum of the London Missionary Society until 1867; in 1902 purchased from Cecil Graham by J. Pierpont Morgan and presented to the American Museum; described in a letter of 1821 as follows: "The head in the missionary museum supposed to be the head of the unicorn, appears to belong to a species of *Rhinoceros* previously unknown in this country."

chiefly a *browser*, its grinding teeth being shorter as in all browsers. Both fossil and living species exhibit a skull with a forwardly inclined occiput; the top of the skull is absolutely concave and hornless in the middle of the fore-

head, whereas the nasals are armed in the middle portion with a bony rugosity to support the great anterior horn, but beyond this the nasals are smooth and terminate in pointed extremities. Thus we readily distinguish the nasal horn region of the true rhinoceroses from the same part of the skull in either the Sumatran type or the next type to be considered, the African.

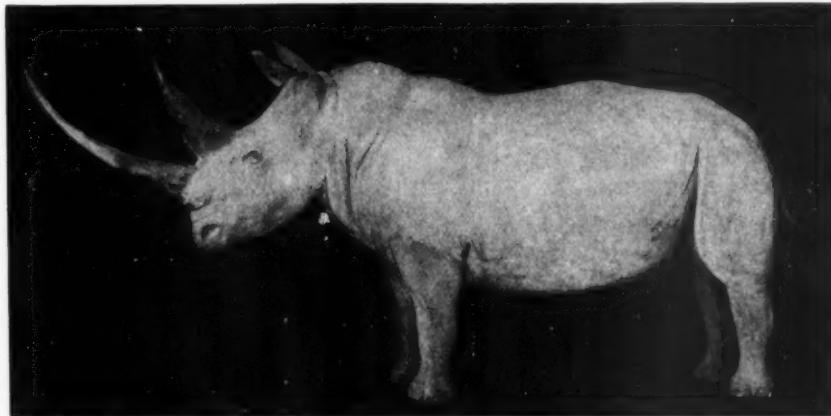
VI. THE RHINOCEROSES WITHOUT CUTTING TEETH, OR ATELODINES, OF AFRICA AND EUROPE

The two living African rhinoceroses, 'black' and 'white,' are the sole survivors of a group of African-European animals readily distinguished from the other groups by the fact that both the upper and lower cutting teeth are vestigial or wanting, evidently because these animals gave up the use of these teeth very early in geologic time and substituted very broad grazing lips like those of the white rhinoceros for the narrow pointed browsing lips that are characteristic of the black rhinoceros. They did not need the cutting teeth as offensive or defensive weapons because the top of the skull was provided with two large, strongly developed horns placed upon the frontals, the frontal horn

both in the white and the black rhinoceros being the most powerful fighting weapon of the kind developed in any quadruped.

The ancestors of these animals, known as *Ceratotherium pachygynatum*, suddenly appear in the famous Lower Pliocene quarries of Pikermi, Greece. It seems probable that these 'thick-jawed' rhinoceroses came to Greece from Africa accompanied by numerous antelopes and giraffes, which also

This thick-jawed rhinoceros of the Greek Pliocene resembles so closely the great woolly rhinoceros of the Ice Age of northern Eurasia, described by Blumenbach in 1799 as *R. antiquitatis*, the rhinoceros of antiquity, that Duvivier believed that the Siberian and Grecian specimens belonged to the same species, and Albert Gaudry remarked in 1862 that this conclusion was very natural because the limb bones are so similar.



Mounted specimen of the superb example of the 'white' rhinoceros, *Ceratotherium simum*, collected by the American Museum Expedition of 1909–15 under Messrs. Lang and Chapin in the Lado district, central Africa, northeast of the Congo forests. Mounted by Mr. James L. Clark for the Roosevelt African Hall of the American Museum

appear to be of African origin. A fine skull and skeleton of the thick-jawed rhinoceros of Pikermi was described and figured in 1862 by the veteran French palaeontologist, Albert Gaudry; even in the skull of the young of this animal there are indications of a very large frontal horn and the nasal bones are very broad and thick at their extremities, adapted to a large nasal horn; the jaws beneath are reduced and the front teeth, which are extremely small, soon disappear. This animal, like the black rhinoceros of Africa, was a browser or shrub eater.

The writer verified these observations by comparison of all the specimens of the black, of the white, of the thick-jawed, and of the woolly rhinoceros, and came to the conclusion that the woolly rhinoceros was intermediate in structure between the black and the white. The white rhinoceros of Africa (*C. simum*) is the largest living type. It has a square upper lip with very broad nasal bones, the horn rugosities being carried out to the very extremity of the nasals so that the horn pitches forward and its cranial resemblance to the thick-jawed rhinoceros is remark-

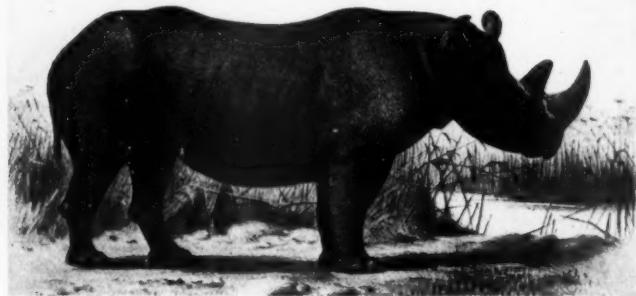
able. The black rhinoceros (*D. bicornis*), on the other hand, has a pointed prehensile upper lip with the somewhat more pointed nasals associated with this narrow snout, yet the horns are carried also to the very extremity. The writer's conception of the woolly rhinoceros, which is shown in Mr. Charles R. Knight's restoration (page 223), indicates an intermediate structure.

These animals were mainly African and European in their migrations but appear to have wandered as far east

able of the rhinoceroses, namely, the great single-horned Elasmotheres, which exceeded all other rhinoceroses in size with the exception of the recently discovered Baluchitheres.

VII. THE ELASMOTHERES OF THE TUNDRAS AND STEPPE OF PLEISTOCENE EUROPE

A peculiarity of these Elasmotheres which gives them their name is the wavy enamel of the teeth, which folds in and out in thin plates, the designation *Elasmotherium* (e.g., ἐλασμός, thin



The 'black' rhinoceros, known as *Diceros bicornis*, of the central African plateau; figured by Philip Lutley Sclater in 1875. This animal is reproduced to the same scale as the rhinoceroses represented on pp. 215, 217, 218, 219, 221; it therefore represents a rather small individual of this powerful animal, which is none the less considerably inferior in size to the 'white' rhinoceros (page 221)

as Maragha, Persia. Their favorite habitat during the Ice Age was the cold steppes and tundras of the North to which they became perfectly adapted through the development of a thick undercoating of woolly fleece of a golden-brown color, a specimen of which is preserved in the St. Petersburg Museum.

The woolly rhinoceros has been found all over Europe, but to the east its geographical range may have been limited by the largest and most formid-

plate, and Θηρίον, wild beast) being applied by the Russian naturalist, Fischer, in 1808 to the first specimen discovered, namely, *E. sibiricum* from the Pleistocene in the vicinity of Miask, Siberia. During the Ice Age these animals were driven as far south and east as central Europe.

They differ from all other horned rhinoceroses in the entire absence of any trace of a horn upon the nasals and in the development in the middle of the forehead of a gigantic bony prominence

which may have borne a huge median horn, or may have supported merely a thickening of the epidermis. It is possible, as observed by the writer, that this median horn may have evolved out of the inconspicuous median rugosity found by him on the top of the *Aceratherium incisivum* skull in the Museum of Darmstadt. The ancestry of the Elasmotheres, however, remains an open question upon which some light will probably be thrown by

Cooper of Cambridge, England, formerly a student in the American Museum, made his expedition into the Bugti Hills of eastern Baluchistan on the borders of India. Here he discovered two kinds of aberrant rhinoceroses,—first, a small animal which he named *Paraceratherium*, that is “akin to *Aceratherium*,” represented by fairly complete skulls and lower jaws; second, evidence of an animal of enormous size the kinship of which he



The woolly rhinoceros, described by Blumenbach as *Rhinoceros antiquitatis*, now known as *Ceratotherium antiquitatis*. This scene is in the steppe period or climate of Postglacial time in northern France. During this period the woolly rhinoceros was portrayed by artists of the Crô-Magnon race in several drawings or etchings, from which this restoration was made. Drawn by Charles R. Knight under the direction of the author

the fossil-hunting parties now working in northern Asia. Suffice it to say that the Elasmotherere skull surpasses in size that of the gray-white rhinoceros of Africa but is still far inferior in size to that of the Baluchitheres.

VIII. BALUCHITHERES, THE GIANT HORNLESS RHINOCEROSES OF WESTERN AND CENTRAL ASIA

Such was the general state of our knowledge of the great family of rhinoceroses and their migrations until the year 1911, when Clive Forster

was unable to determine with certainty although from the first he suspected its relationship to the rhinoceroses; this animal he named after the region of its discovery *Baluchitherium*, the wild beast of Baluchistan, and the specific name *osborni* he assigned to it in honor of the present writer.

In a series of papers Cooper described the perfectly gigantic neck bones of this animal and parts of the foot and limb bones exceeding those of the elephants in size. Finally, in February, 1923, he concluded that *Baluchitherium*

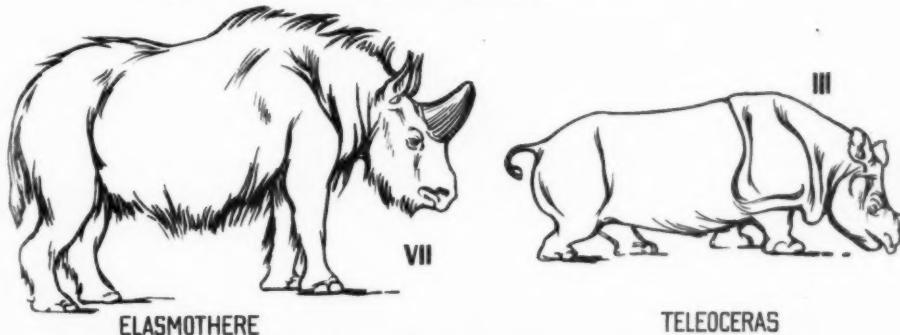
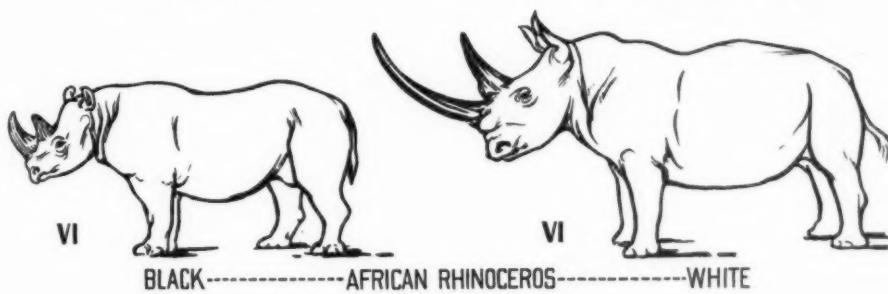
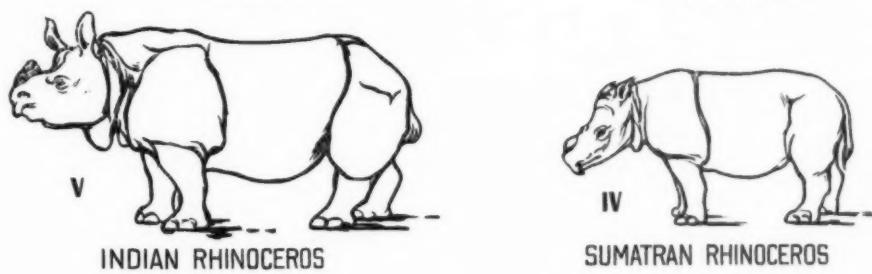
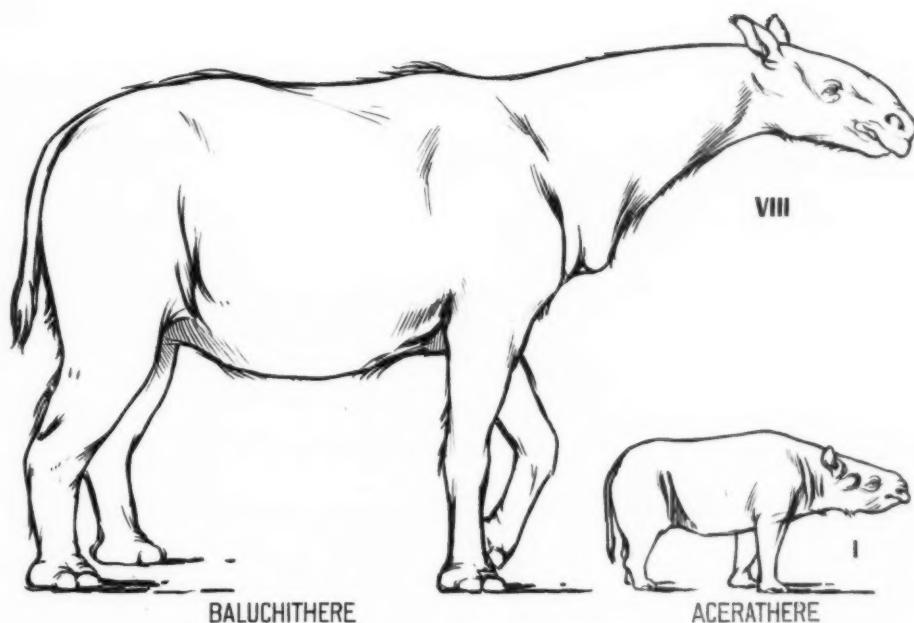
may be described as the only known member at the end of a series of odd-toed ungulates, extremely tall-footed, probably long-headed, of primitive kinship to the rhinoceroses, somewhat masked by adaptation to weight, the direct line of ancestry being as yet unknown. This excellent conjecture of 1923 was partly based on the discovery by the Russian palaeontologist Borissiak in Turgai, northern Turkestan, of a gigantic animal to which he gave the name *Indricotherium asiaticum*. Borissiak was fortunate enough to discover not only parts of the skeleton but well-preserved grinding teeth, which he immediately observed were like those of some of the large Oligocene Aceratheres above described. It was found that the Turkestan animal is very closely similar in size to that from Baluchistan so that Forster Cooper and Borissiak together added to the rhinoceroses of the world a new animal of gigantic size without being able to determine precisely its affinities to the other rhinoceroses.

This was the condition of our knowledge when the Third Asiatic Expedition left Kalgan on April 21, 1922. The first giant bones were discovered on the journey north toward Urga near Iren Dabasu, consisting of an enormous heel bone (*os calcis*) and other bones of the foot and wrist which were recognized at once as comparable in size to those of *Baluchitherium*. The second and most important find was made on August 5, 1922, near Loh in the Tsagan Nor Basin: this was a skull with portions of the jaw, the lower end of the shoulder bone, and the humerus. The skull and jaw were about fifty feet apart but probably belonged to the same individual. About a quarter of a mile distant were found the remains of a third specimen.

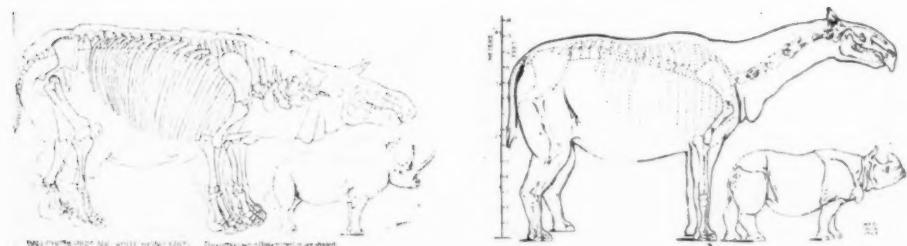
Fortune favors the brave and the well prepared: about half the skull was found in large sections, the remainder was weathered into hundreds of fragments. From an examination of the larger pieces and the 360 fragments of bones and teeth which belonged to this remarkable specimen it was recognized at once that it might be possible to reconstruct the skull. These larger and smaller parts were excavated by Mr. Walter Granger with the skill and cunning which comes from twenty-five years' experience in the western badlands of the United States. The packing of this skull, its transportation across the desert of Mongolia, its preservation from bandits and from the unpaid Chinese soldiery, its journey to Peking, thence to the nearest port, and finally its safe carriage to the American Museum, where it arrived absolutely uninjured on December 19, 1922—these are among the great events of palaeontologic history.

It required three months of the most skilful work in the Museum laboratories to prepare and restore the skull and jaws, as they are now shown in the photograph on page 227. From the first the animal seemed incredibly large; it was hard to believe that it was actually a reality; it immediately justified the estimate of its original discoverer, Forster Cooper, that it was probably the largest land animal known, taller than any of the existing elephants, dwarfing the existing or fossil rhinoceroses, equaling or exceeding in height the most lofty of the extinct elephants.

The two restorations which are reproduced on page 226, to be known as the first and second restorations, show the successive attempts to portray its size. The first restoration, which was hurried forward soon after the



RHINOCEROSES, LIVING (FACING LEFT), EXTINCT (FACING RIGHT)
Baluchitherium grangeri (VIII) towers over all of its relatives (I-VII)



To the left is the first restoration of *Baluchitherium grangeri*, estimated as 12 feet in height at the withers, a massive animal towering above the existing 'white' rhinoceros placed beneath its head and neck.

To the right is the second restoration of *Baluchitherium grangeri*, estimated as 13 feet in height at the withers, towering above the Indian rhinoceros placed beneath its head and neck. In the second restoration the bones thus far discovered are represented in solid lines, the conjectural bones in dotted lines. The body outline in both restorations is highly conjectural.

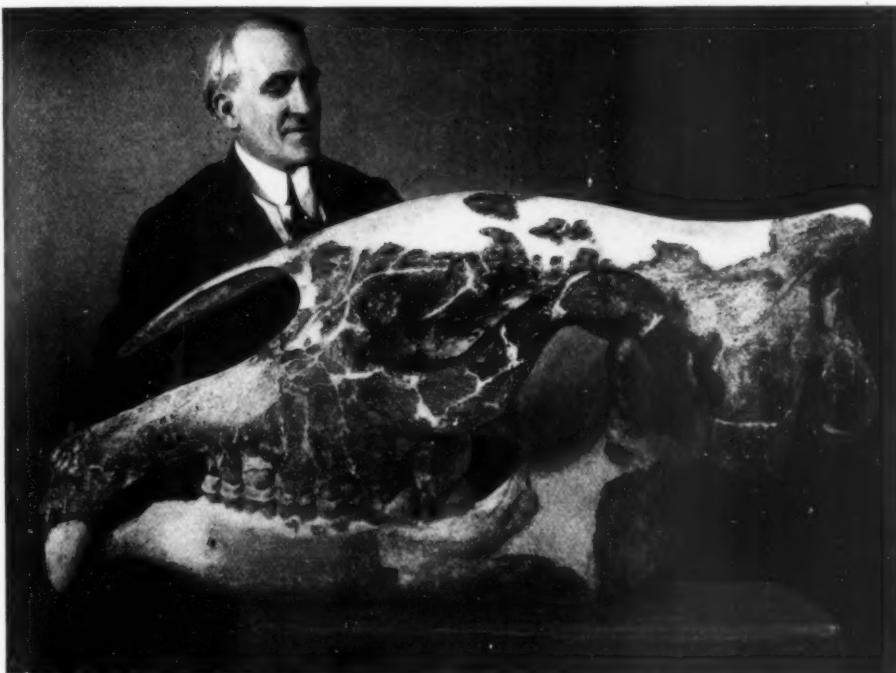
great skull arrived, represents a very massive animal proportioned somewhat like the rhinoceros, of a shoulder height of 12 feet, making the gray-white rhinoceros of Africa appear like an infant. The second restoration, dated March 24, 1923, prepared under the direction of the writer, changed the proportions considerably, giving the animal the greater height of 13 feet at the shoulders and a relatively longer neck. The head reached a normal height of 14 feet above the ground but readily attained a height of 16 feet when the creature stretched its neck. In this second restoration the body is relatively shortened, the limbs relatively lengthened. With the able assistance of Dr. William K. Gregory, the writer calculated with great care the body proportions of *Baluchitherium* as compared with those of the white rhinoceros, of the black rhinoceros, of the Oligocene Aceratheres, of the short-footed Teleocerine rhinoceroses, and finally of a gigantic horse bred in Kansas that attained a height of 18½ hands, or 6 feet, 1 inch. It was proved that *Baluchitherium* surpassed both the living African and Indian elephants in height because while its limb bones are

equally long, its foot bones are relatively longer and more stilted, as observed by Forster Cooper; consequently it is a rhinoceros on stilted limbs with extremely long neck, proportioned as in the horse but of massive size.

With this elevated body form and massive neck, the head, gigantic as it at first appeared, diminishes in relative size, although far exceeding that of any existing mammal in absolute size. This very long narrow head placed at the end of an extremely long neck and provided with short grinding teeth, like those of the browsing rhinoceroses we have described, namely, the Aceratheres, the black rhinoceros, the Sumatran rhinoceros, and the Sondaican rhinoceros, compels us to believe that *Baluchitherium* was a gigantic browser, feeding upon leaves and twigs, buds and blossoms. It was certainly not a ground browser, like the black rhinoceros, whose head is carried very close to the ground, but more probably a tree browser, comparable to the giraffe and okapi among the even-toed animals and to certain other tree browsers among the odd-toed ungulates or hoofed animals.

In the third restoration (page 208), executed under the writer's direction by Mrs. E. Rungius Fulda, the *Baluchitherium* is represented as a gigantic tree browser stalking about among the fertile savannas of ancient Mongolia, in Upper Oligocene or Lower Miocene times, well protected from its enemies

evolution that the anterior part of the body of tree browsers is harmoniously elevated with the elongation of the neck. It is obvious that tree-browsing animals of increasing height of body and of shoulder, of a generally increasing length of neck, and of increasing stretch of prehensile lips



Skull of *Baluchitherium grangeri* as finally restored and ready for casting on May 1, 1923, in the laboratory of the department of vertebrate palaeontology of the American Museum, by Otto Falkenbach of the department staff. This photograph gives an idea of the gigantic size of this skull, which is nevertheless relatively small as compared with the bones of the skeleton, as shown in the two restorations on page 226

by its very great height and by its power of locomotion, surpassing in speed that of the elephants and of the swiftest rhinoceroses, living or extinct.

The writer anticipates that when the complete fore limb and shoulder blade of this giant animal become known, it will be found that the shoulders were well elevated above the hips because it generally happens in the course of

adapted to feeding on the herbage of the higher branches of trees would up to a certain point become increasingly tall through the process of natural selection and survival of the fittest, which in our opinion is the best explanation of the long neck of the giraffe.

Finally, what is the relationship of the Baluchitheres to the other rhinoc-

ceroses? Are they simply giant Aceratheres? This conjecture would at first appear to be probable from the close similarity in size and proportions of the skull and the absolute hornlessness of the skull, for both the frontal and nasal bones are perfectly smooth without any trace of a rugosity. But the very powerful superior tusks present a difficulty in the acceptance of this theory; there is nothing resem-

bling the *Baluchitherium* tusks in any other member of the rhinoceros family in which the remaining upper incisors are either short-crowned or vestigial but never tusklike or pointed. In *Baluchitherium* they are veritable tusks, shaped like canines or eyeteeth, terrible weapons of offense and defense, and wielded by a skull of surpassing size and weight and by a neck of gigantic proportions.



Map of central and southwestern Asia showing the type localities of (1) *Baluchitherium ostorni* type, eastern Baluchistan; (2) *Indricotherium asiaticum* type, near Turgai, northern Turkestan; (3) *Baluchitherium grangeri* ref., near Iren Dabasu, southeastern Mongolia; (4) *Baluchitherium grangeri* type, near Loh, central Mongolia

NOTES FOR THE READER AND THE STUDENT

The reader who desires to follow up this subject is referred to Dr. Philip Lutley Sclater's Memoir of 1875 "On the Rhinoceroses Now or Lately Living in the Society's Menagerie," which appeared in the *Transactions of the Zoological Society of London*; also to the Memoir of Henry Fairfield Osborn (1898) entitled *The Extinct Rhinoceroses* or to his *Bulletin* (1900) on "The Phylogeny of the Rhinoceroses of Europe." Many recent papers of great interest have been published, especially on the woolly rhinoceros of Starunia by Dr. E. Niezabitowski. On the Baluchitheres the chief papers are by C. Forster Cooper and A. Borissiak, cited by the present writer in the first description of the skull of *Baluchitherium grangeri* in American Museum Novitates No. 78. In all 264 titles of papers and memoirs relating to extinct and living rhinoceroses are contained in the Osborn Library, a branch of the main Library of the American Museum.

The reader whose interest may have been

aroused by this article will find in the American Museum the finest collection of fossil rhinoceros remains that has ever been brought together, including a superb collection of fossil and recent skulls from all parts of the world, three beautifully mounted specimens of the gray-white rhinoceros collected in the Congo region by the Lang-Chapin Expedition, and especially a series of mounted fossil skeletons of Aceratheres, of Diceratheres, and of the *Teleoceras*, to which will shortly be added a diminutive *Trigonias* from Colorado. The *Elasmotherium* skull alone is represented by a cast; all the other skull types are originals including that of the recently finished skull of *Baluchitherium grangeri*. The interested visitor to the Museum should also see representatives of other main branches of rhinoceros affiliation known as the aquatic Amynodonts, which like the Aceratheres roamed through Europe and across Asia to North America; also the cursorial rhinoceroses or Hyracodonts which were confined to North America.



A haunt of the American bittern near Arnprior, Ontario. This beaver meadow is flooded every spring with the high water from the Ottawa River, and here in the month of May, the American bittern can be heard chanting his extraordinary mating song. With a little maneuvering you may see him at such times engaged in the apparently very difficult task of producing the strange sounds he passes off as a love ditty

Some Bird Voices of the Northern Woods¹

BY CHARLES MACNAMARA

ALTHOUGH members of the same bird family may differ much in size and appearance, there is often a remarkable resemblance in their voices. Alike in the "scream of freedom" of the great bald eagle and in the shrill piping of the little sparrow hawk is heard the same high-pitched note characteristic of the whole falcon family. All the ducks quack, and the same wild plaintiveness prevails throughout the voices of all the snipe and plover clans. The artless lilt of the song sparrow is typical of many of the sparrow tribe, and can be traced

even in the elaborated song of his cousin, the goldfinch. The wood warblers, who belie their name, being very poor warblers, are notorious generally for their thin wiry voices; while the thrushes all have the same rounded mellow notes—the wood wind of the orchestra—a quality to be detected even in the unassuming monotonous phrasing of the robin, and in the soft resigned notes of the bluebird, both of whom are, of course, members of the thrush family.

The hermit thrush gets his name from his shy retiring habit. He is

¹The birds considered in the article were visitors to Arnprior, Ontario, Canada.

truly a bird of the deep woods, and lives distant from human habitations, but the name is not quite appropriate. We always think of a hermit as an ascetic celibate, and the thrush takes a wife and rears his young, and no doubt enjoys life as much as any other bird. His song, a simple theme of grave flutelike notes in slow tempo, has all the dignified solemnity of a hymn. He is rightly accounted our finest singer, but his stage presence is poor, and his personal appearance is scarcely in keeping with his elevated music. He is a rather perky little bird, with an exasperating habit of nervously jerking his tail. He seems to know the limitations of his looks, and never shows himself much in public. Wisely, he is content to be a voice and nothing more.

The hermit thrush is the brother who went to Europe to study singing and became a grand opera star. The robin is the brother who stayed at home on the farm and whose public appearances as a singer are no more pretentious than the concert in the district school house. But the hermit's exalted song is far removed from everyday life, and is almost too pure for "human nature's daily food." We cannot long maintain so lofty a mood; while the homely ringing notes of the robin, sung perhaps from the peak of the back shed against a chilly sunset of early spring, give more pleasure to more people than the song of any other bird in North America. Consequently the robin is our most familiar and best-loved bird, and his spring coming is a marked event. Men who do not know an English sparrow from a junco, tell one another cheerfully that they saw a robin this morning, and his arrival is gazetted in the newspapers.

Another early and familiar singer is the song sparrow, whose naïve little

performance probably resembles the song of the canaries' primitive ancestor. I think this must be the most cheerful little bird in the world. Nothing seems to dishearten him. He pipes his simple lay in all kinds of weather, and even in the middle of the night; wherefore the French Canadians call him the *rossignol*, or nightingale. Pouring rain cannot dampen his spirits, and once, when I was driven to take refuge under a pine tree from a driving sleet flurry that blotted out everything beyond twenty feet, in the midst of the storm a song sparrow close by burst into song. But his demonstration under such circumstances seemed out of place. Such absolute indifference to conditions is more like mere insensibility than real good humor.

The white-throated sparrow also comes early in the spring, although not so early as the song sparrow. He is silent for the first few days after his arrival but can sometimes be provoked into premature song by a human imitation of his whistle. There is a certain setting proper for each bird song. For the whitethroat you should be walking a mossy path in deep tangled woods, with a quiet rain tapping lightly on last year's leaves. Then from the thicket comes a song that to me, given to visualizing sounds, is a keen bright silver thread weaving into the gray day. A cool and tranquil song, expressive of the very spirit of the still, northern forest, it seems untouched by any hot emotion. But in reality it is doubtless a love lyric combined with a warning to claim-jumpers to keep off the singer's preëmpted area. It is answered in the same measured tones by another whitethroat a hundred yards away, and the challenge and counter-challenge continue as long as you are in hearing.

If the whitethroat's voice is silvery, the Baltimore oriole's is golden. Usually, just as the leaves are unfolding, he commences his singing. His prelude is like the notes of a clarinet beginning an Hungarian dance, but there is a plaintive sadness in his lovely liquid warbling which sounds like a regret that springtime is so brief. He is seldom heard after the middle of June. The thrushes, sparrows, finches, and many other birds are formal singers who perch ceremoniously on a bough to deliver their music. But the oriole sings at his work, and while he is busily searching for insects, his full-toned notes keep on without interrupting his intent examination of the branches.

Our goldfinch, like our robin, is called after an Old-World bird of a different species. Our robin is a thrush while the European robin is a warbler, but our goldfinch really is a finch, and shows his family connection in his song, which in a wild untaught way resembles that of the domestic canary, the master singer of the finch family. There is no regret in the goldfinch's song. He is another formal singer, and his crystal trills and runs, poured out from his perch on a branch, express nothing but high spirits and exuberant joy. His nuptial flight song is even more intense. One very hot day in July I noticed a goldfinch flying in circles above an old log fence and singing in ecstasy. He flew steadily and not in the usual undulations of his kind, and his rhapsody at no time ceased. I don't know how he managed to draw his breath. As I came nearer, I saw the female to whom this passionate homage was being paid. She sat on the fence, apparently giving little attention to the outpourings of her suitor's soul. She did not intend to let

him win her too quickly, and presently she flew away, followed by her lover, who now dropped into the wavy flight and gave forth the usual call note of *per-chic-o-pee*.

As I have said, this was on a breathlessly hot day in July, and the occurrence interested me as it recalled another nuptial song I had heard in the contrasting weather of a very cold day in January. It was perfectly calm that day, the sun was bright in a cloudless sky, but the temperature was considerably below zero. Snowshoeing through a wooded swamp, I was remarking the silence of the winter woods when a bird song burst forth from the top of a tall red maple. High up in the cold bright sunshine a white-winged crossbill was flying out in circles and returning to perch on the topmost twigs, warbling all the while as eagerly as if it were summer time. I could see no female, and in view of the earliness of the season and the severity of the weather I might have doubted that this was a nuptial song. But I had lately obtained proof of a crossbill actually nesting in January in this district, so I was sure that my bird, despite the extreme weather, was really out courting.

What some of our birds need is a good press agent. For ages innumerable poets of all countries have been "writing up" the nightingale, so that now everybody thinks of it as the finest singer in the world, although I have a suspicion that some of our native songsters are quite its equal. On this continent the mocking bird is celebrated in a famous song, and the thrushes, the bobolink, the oriole, the catbird, and others have gained great reputation with the general public from the applause of various writers, both in prose and verse. But who, except the

earnest bird student, knows even the name of the winter wren, and how many have heard his entrancing song? The answer is: very few. Therefore, I propose to advertise the winter wren a little.

Everywhere a favorite family, the wrens are the subject of numerous legends, and the hundreds of vernacular names that have been given them attest the affection of the people for them. But they have never been counted among the great singers. Our familiar house wren sings a defiant little jingle, and he means every scolding note of it, for he is one of the most quarrelsome of birds. The singing of the family in general, however, is undistinguished, except that of our friend, the winter wren, and he amply makes up for any musical shortcomings of his relatives.

I think my experience with this bird may resemble that of a good many other bird students. When walking in the woods in spring, I sometimes used to hear from low down in a brush heap or thicket tangle an explosion of bird music which for richness and finish surpassed any other song I knew. It was a rapid gushing melody, clear and loud, without a trace of the amateurish "home made" quality heard, for instance, in the song of the robin. This was the production of a highly cultured performer—a bird Tetrazzini,—and its motif seemed to be the joy of springtime living. Though the singing was usually near at hand, it was some time before I could find the bird. When I came closer, the song would cease, or would burst out again farther off, resembling in this respect those better days that are always a little ahead of us.

At last one April day I caught sight of the singer. It was a little bird of the

conventional wren-brown, with an absurdly short tail sticking pertly up over its back, a quaint and undignified little bird, astonishingly small to produce so powerful a voice. It was slipping expertly in and out of the forest cumber, searching minutely for insects and singing its wonderful song every minute or so with scarcely a pause in its work. As I watched it, it came quite close, so that I could see its tiny throat pulsing rapidly as it sang; and I noticed it could sing with its bill full of spiders. Only, as its mouth filled up, the music grew softer, and the gradual diminuendo produced a curious "Turkish Patrol" effect. At last the little bird worked out of my view, but for some time I continued to hear its rich treble with the distant drum roll of a ruffed grouse for a bass background.

The winter wren and most of our other good singers are birds of dull plumage. Apparently a fine voice alone is often enough to win a mate without any need for fine feathers. Of course, there are exceptions. That Chrysostom of birds, the Baltimore oriole, in his rich orange and black livery is one of our handsomest migrants; and the goldfinch is very gay in summer in his vivid yellow and black. The lovely rose-breasted grosbeak, too, sings a wild wandering aria mindful of an uneducated oriole. But the greater number of our bright-hued birds, such as the blue jay, the red-headed and pileated woodpeckers, the flicker, the ruby-throated humming bird, the redstart, and other gemlike warblers are all non-singers. The purple finch—which is not purple at all, but gloriously flushed with crimson—is, I admit, well spoken of as a singer, but to my ear its song sounds rather flat and rattling. And the

scarlet tanager, of a brilliance so unexpected in these northern climes that he is sometimes mistaken for a tropical bird escaped from captivity, must also be regretfully denied a place in the choir. His call note of *chip chur-r-r* is loud and harsh and his attempt at a song is no better.

On hot days when I am out in the woods, I like to eat my lunch on a little rocky point that juts out into the Ottawa and catches any breeze that may be blowing over the river. There are a few stunted pines and cedars on the point and the bearberry vine manages to grow between the stones. This is where I sometimes hear the tanager singing from the trees of the mainland. It is an unmelodious song, not easy to describe, but is such as one might imagine a demented robin to make if he tried to imitate the grating notes of a crested flycatcher. But here it is often accompanied by the mighty bassoon of a bullfrog; and as I eat my meal and look out over the blue waters, I delight in a jazz duet such as no fashionable restaurant in the world can offer its diners.

Bird voices are sometimes represented by syllables or words as an aid in recalling the sounds. Though most of the inventions demand a lot of imagination, a few of them are very good. It is true that no bird can really pronounce a consonant, but I imagine that even if a perfect stranger were told that the chickadee called its name with a couple of extra syllables, *chick-a-dee-dee-dee*, he would at once recognize the bird by its voice. *Whip-poor-will* also expresses fairly well the cry of that nocturnal bird, which, not very common in the settled country, sometimes makes the backwoods ring with its whoops. Once upon a time awaking at dawn in a river-drivers' camp, I

estimated that, near and far, I was listening to one hundred of them calling together, but perhaps resentment at the untimely noise supplied a rather large factor to the number. Another bird that speaks its name plainly is the phoebe. It pronounces the syllables in a crisp business-like manner, very different from the way its melancholy brother, the wood peewee, drawls out its low-spirited *p-e-e-e-a-w-e-e-e-*. If you see a small yellow bird wearing a black domino mask, and calling *witchitee, witchitee, witchitee* with the accent on the first syllable, you will know that you have the pleasure of meeting the Maryland yellowthroat. One of the many cries of the blue jay is aptly rendered as *thief! thief!* This he screams as he flies away, adopting the old trick of the real thief joining in the hue and cry in order to draw attention from himself.

There are no absolutely dumb birds. All possess some means of vocal expression, but some have such weak voices, or use them so seldom, that if we wished to be technical, we might erect a division of birds called the "Aphonopteridae." One that would belong here is our only humming bird, the ruby-throated, whose thin squeak is seldom heard. Perhaps like the bat's cry, it is pitched too high for most people's ears. Another silent bird is the exquisite smooth-feathered waxwing. Its ordinary note is a faint wheeze like the creak of an unoiled hinge, and its "beady" call on taking flight is not much louder. The ruffed grouse practises only a few chirps and clucks; it is blessedly free from the boisterous crowing and cackling of its close relative, the domestic fowl. The Canada jay, or whisky jack, when hopping around your camp fire looking for scraps, seldom utters a sound, although I have sometimes



The Canada jay or whisky jack is a familiar visitor at every camp in the northern woods. The tent is scarcely pitched before he arrives, looking for scraps. Usually a silent bird, he is capable of a large variety of notes, nearly all harsh

heard them give a low whistle. But when they like, they can raise as much disturbance as their disreputable brothers, the blue jays. One day last winter when I was visiting the beaver dam that is the pride of the little game sanctuary near where I live, a hawk flew overhead just above the tree tops. I began to imitate its whistle as well as I could, trying to induce it to answer me. I had whistled only three or four times when a sudden unexpected whisky jack came hurrying through the trees toward me, vociferating a series of quick raucous cries, the significance of which I have never quite determined. Was my hawk imitation so good that it had deceived the bird and he was shrieking in alarm? Or was it so bad that he was jeering at me in derision? I do not know; but anyway, after a while I got the hawk to answer me.

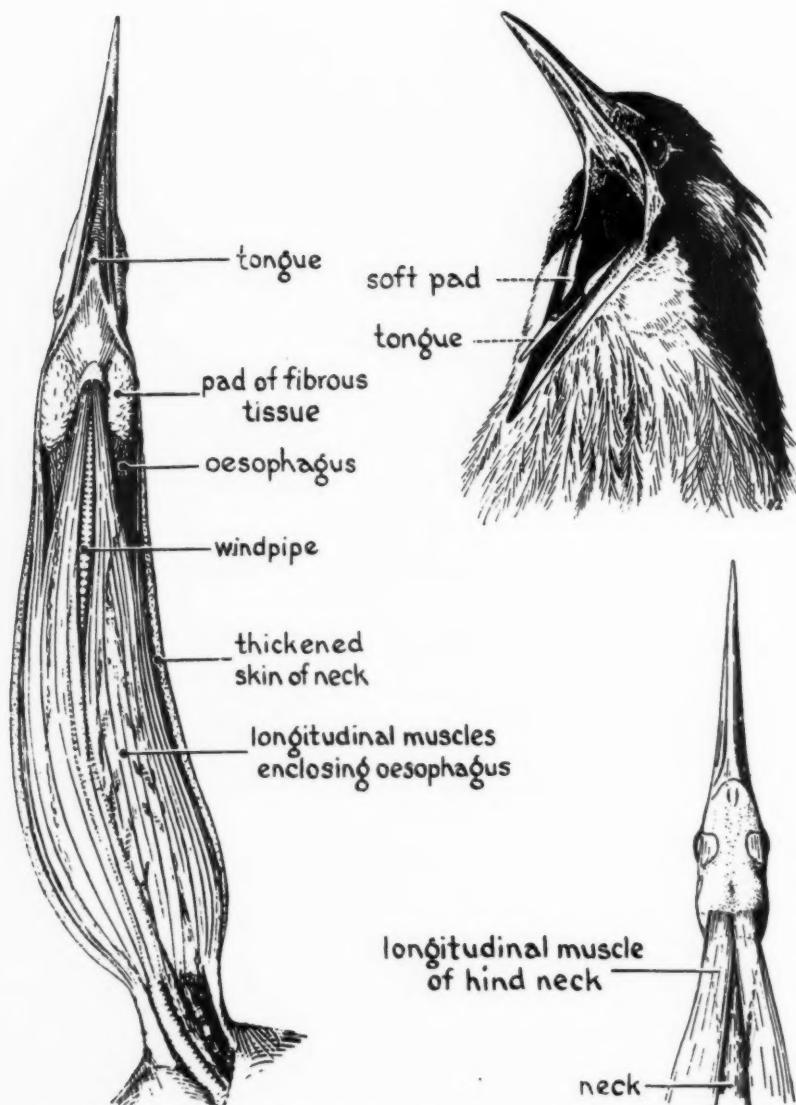
Another unofficial category might be formed of birds that think they can sing and can't. The leader of this class is undoubtedly the friendly little chipping sparrow. He is a most persistent singer, and a nightingale could not be more earnest in its endeavor. The result, alas! is only a tuneless trill, though it seems to give the neat little bird every satisfaction. Another serious and persevering singer of the same type is the slate-colored junco, who achieves little more than a vibrating chatter. Perhaps the black-and-white warbler is not really pretending to sing with his insect-like *zee-zee-zee*, nor the industrious red-eyed vireo prattling interminably on his daily round not merely of inspection but of scrutiny through the trees. But the redstart certainly thinks he can sing. Watching him, one thinks he must have taken lessons in voice production, for he throws back his head and opens his tiny bill widely. But if he has, his teacher should return the fee, for the voice that issues is only a meager sizzle.

Traversing all accepted classification, another division might be formed of birds whose voices do not sound like those of birds at all. The voices of most of the perching birds are in the upper registers, so that when we hear the low-toned *quank* of the nuthatch, or the soft deep notes of the cuckoo, we can hardly believe that the sounds come from a bird. The great horned owl's horrifying shriek is another inconceivable bird voice, and is usually attributed to a lynx or some other bloodthirsty animal. The voice of the saw-whet owl is generally described as sounding like a file being dragged across the teeth of a large saw. This little owl is rare in my district, and it is many years since I have heard it, but my recollection is that the cry was astonish-



WHERE THE VIREO IS HEARD

One of the most typical bird voices of summer time is that of the red-eyed vireo. And it is by his voice alone that most people have knowledge of him, for this "gleaner among the leaves" is seldom seen. Essentially a bird of the woodlands, he frequents the tops of the highest trees, scrutinizing every leaf and twig for insects, all the time uttering a slow unending succession of notes; and as the phrases each end on a rising inflection with a slight pause between, he seems to be asking a series of earnest but never-answered questions. This peculiar delivery has earned him the popular name of the "preacher." He keeps up his unceasing prattle all day long, and is often the only bird to be heard in the noontide heat.



These drawings show the mechanism connected with the bittern's unusual voice. The whole neck (left) is seen from below, the hind neck (lower right) from above, and the open gape (upper right) from in front.

During the breeding season the skin of the male bittern's neck is distinctly thickened. Beneath it lies a thin layer of muscle which supports this heavy skin. Perhaps the soft pads along the inside of the lower jaw, as well as the lumps of fibrous connective tissue at the sides of the throat, aid the bittern in retaining the air in the oesophagus when it is blown up during the "stake driving." After James P. Chapin, (*Auk*, Vol. XXXIX, pp. 196-202)

ingly like the clink of a hammer on an anvil. Another "mechanical" bird ery is the hunger call of young chimney swifts, who make a noise far more like the rattle of a badly constructed

machine than the voice of any living creature. But perhaps the most extraordinary of all bird voices is that of the American bittern, and the popular idea still is that the mud and water of

the bogs in which the bird lives must have something to do with his incredible *chunk-er-lunk*. All ornithologists know that the sound is produced solely in the bird's throat, but the method of production is nevertheless very remarkable.

For two days I had been looking for a miserable difference of 25 cents in a trial balance. At last, when my delighted eye caught sight of the elusive "quarter," which had not been brought down from the last month's balance, I shut the books and went out for a walk of thanksgiving. Such good fortune would have satisfied me for one day, but I was in for more. I headed for a flooded beaver meadow, and there, like the Lady of Shalott, I "found a boat beneath a willow left afloat." It was flat-bottomed with square ends, it leaked a little, and its equipment was a single rude paddle chopped out of a slab; but it was enough. The meadow was busy with insects, fish, frogs, turtles, birds, and musk-rats all industriously making their living. As I was paddling slowly across the water, watching their vital interactions, I saw an American bittern standing about 150 feet away in the shallow water beside a partially submerged bush. He was stock-still with his bill pointing skyward in the traditional bittern attitude. Presently, as a bubble swelled out in his throat, he developed a slight hiccup, which rapidly became worse until it culminated in a frantic retching with racking contortions of his neck. The accompaniment to this was the well-known "stake-driving" sound. The attack lasted ten to fifteen seconds, and when it subsided he stood motionless, once more pointing the way to the stars. But he enjoyed the respite only a minute or two. Then he had another

of the alarming seizures, and the attacks followed one another with short intervals during the half hour I watched him, at the end of which increasing rain drove me home. Such is the bittern's love song. Love seems to be a painful and violent passion with bitterns.

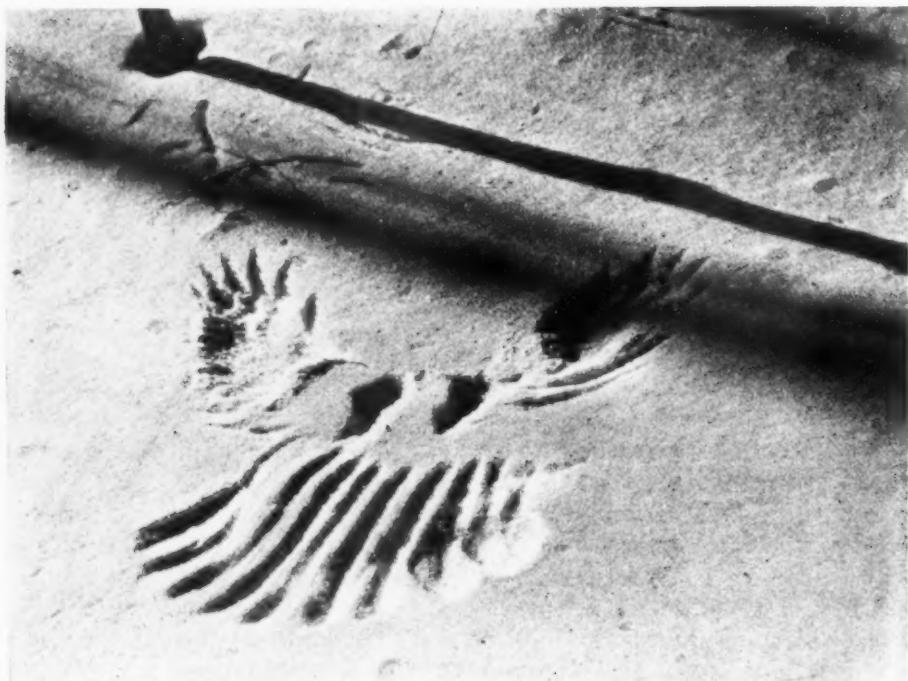
The northern raven is an untamed dweller in the wilds who never ventures into civilization, but he is well and unfavorably known to log makers. The French Canadian shanty men say that he calls *poche, poche*, referring to the bag in which they carry their mid-day meal. If the "poche" is not hidden under a stump or buried deep in the snow while the log-makers are at work, the raven is very likely to tear it open with his powerful bill and eat the men's lunch of bread and pork. I set out one winter day from a lumber depot to walk to a camp a few miles distant. The road through the forest forked several times, and after a while it dawned on me that I had taken a wrong turning, for there was no sign of the camp, and I had already walked more than its distance from the depot. Just then I heard a small, hoarse dog barking a little way ahead. There, I thought, is a gang of log-makers who have a dog with them. I shall get my directions from them. But "the small hoarse dog" was a stately raven who made no more obeisance to me than his famous ancestor did to Edgar Allan Poe. With a few more gruff barks he flew away over the trees, and I had to return to the depot without reaching the camp that day.

There are many other birds whose voices I like to call to mind, but only a few can be noticed here, and they must be passed with a mere mention: the bobolink gurgling and klinking on fluttering wings over new meadows; the comedian catbird giving his clever

but ill-natured burlesque of all his acquaintances; the brown thrasher singing his fine, if somewhat artificial, song in a wayside bush; the rich mellifluous warbling of the purple martins from the veranda of their community house; the trumpet clangor of the wild goose squadron against a seamless gray sky; the shout of the loon answering you back across the water of a pine-rimmed lake; the quavering wail of the little screech owl on moonlight nights, sometimes heard even in towns where he comes to search the cornices of buildings for sleeping English sparrows;

the spring laugh resounding through the open woods of that bird eccentric, the flicker; and the "rusty gate" creak of the iridescent blackbird just arrived, as impudent as ever, from the lost cities of Yucatan.

Of these voices and the others we have considered, some are musical and some could scarcely be harsher, but the true lover of birds finds none of them disagreeable. My affection for birds is without prejudice. I like them all equally and cannot tell which of their voices I like the best.



THE SIGN MANUAL OF THE GREAT HORNED OWL

The common cry of this fierce bird marauder is a hoarse, long-drawn variety of the "hoot" practiced by all the owl family. But on occasion he gives vent to a horrifying scream, more like the voice of some ferocious wild beast than that of a bird. This photograph shows where a great horned owl struck at a squirrel on a branch above, but missed, and came down in the snow with outspread wings and tail.

Nature and Human Nature in a Probationary Classroom

By LUCY CLARKE SIMONSON

Teacher, Public School 120, Bronx Children's Court Annex, New York City

ONE up, Mrs. Forster!" "All right," calls the cheery voice of the matron from the third floor, and Mrs. Forster steps forward, unlocks the wire gate at the head of the stairs and stands waiting to receive the latest member of our family.

He proves to be a boy brought in from the street after hiding several days in an empty freight car at the railroad yards. As he ascends the stairs, his mind is distracted between the dread of being sent home and meeting an angry father, and his apprehension regarding the unknown dangers of his new situation. Coming within sight of the open gate at the top of the stairs, he sees a motherly woman who notes his neglected appearance, evidence of his having shifted for himself, as well as his expression of chagrin and resentment at having finally been "locked up." Putting her hand kindly on his shoulder, she looks into his face with the understanding which has come from meeting thousands of boys and girls in trouble, and says, "Well, son, what's the matter?"

Such is the reception given to each child who climbs the stairs of the Shelter maintained in connection with the Children's Court by the Bronx County Society for the Prevention of Cruelty to Children.

The necessary preliminaries over, the new boy takes his place in the schoolroom among other boys who like himself are finding temporary shelter and motherly care while their cases are being disposed of. It is my privilege

to be the teacher assigned to this class of children.

In this one small schoolroom, which at night is used as a dormitory, there are children who have come from homes disrupted through sickness, death, or crime; boys who have found crowded home conditions unbearable and have broken loose from parental restraint; boys who have yielded to the temptation to satisfy their craving for pleasure by thieving; truants either through mental incapacity for the work of the schoolroom or through natural restlessness which takes them to the street bent on mischief; psychopathic cases that have been brought in because of uncontrolled acts; as well as subnormal and feeble-minded children, the "misfits" in home and school; boys who have run away from their homes in neighboring cities; all ages from six to sixteen; all races; all conditions of mind and spirit. They are all transients, their stay in the Shelter averaging only six days.

With this diversity in age and condition and with the shortness of the children's stay—although of course I teach the regular school subjects—it is impossible to follow a complete course of study with any continuity. Every day I must adjust myself to the class as I find it, and the work of necessity is fragmentary and unsatisfactory.

To prepare the schoolroom for the boys, whom I meet first in the morning, everything is made as cheery and home-like as possible. Chairs are placed around the teacher's desk in a semicircle with a small table near by on which

are the current magazines appropriate for all ages. We usually start with talks about what is going on in the outside world, and the pictures which I bring illustrating the news of the day are much appreciated. These talks include anecdotes of interest about living heroes, discoveries in science, new inventions, and live, interesting stories. Most of our children come from narrow and contracted homes, where parents are too much absorbed in the struggle for existence to talk over interesting subjects with them. I try to lead their minds away from their narrow street life, into bigger places, where imagination is quickened and vision enlarged.

One never knows just what question a boy may ask; so I was not surprised one morning when a lad anxiously inquired, "Teacher, is the world coming to an end? The papers say something's going to smash into us, and the world's coming to an end."

Not answering his question at once, I began to explain the marvelous movements of the heavenly bodies, each one in its appointed place at its appointed time, our own earth spinning through space at the rate of a thousand miles a minute. At about this place in the story, as I was leading the boys' minds to the thought of a Higher Power, who guides the universe without friction and without accident, I saw that I had made my point clear, when one boy, expressing the idea in his own crude way but with all reverence and wonder, burst out with "Gee! *Some Traffic Cop!*"

Sometimes a simple experiment by the boy himself seems to be the most effective way to convince him of a natural force. I recall an overgrown fellow expressing his contempt for any statements regarding the movements of the earth, even the cause of day and

night. With his air of superiority he said, "How can you prove anything?" Noting at that moment the early morning sunshine streaming through the window, I handed him a piece of chalk, suggesting that he trace a mark along the slanting line made by the sun across the floor. Then I told him to watch and see if there was any change. As the morning advanced and his chalk line was left in the shade, his astonishment was profound, and I saw that no comments of mine were needed to impress the lesson.

Probably not one of the regular callers at our building is looked for with happier anticipations than Mr. Herman Sievers, the messenger from the American Museum of Natural History, who regularly and cheerfully brings the natural history specimens and the valuable lantern slides. His appearance usually brings out the eager question, "Movies, teacher?" the younger children calling anything in the line of pictures "movies."

Many of the truants come to us with a distaste for school, from which "playing the hook" seems to be their only escape. Their inability to read without great effort causes them to look upon books as a bore. As they have never formed the habit of reading for pleasure, their leisure has been occupied in making mischief on the street or going to motion-picture shows. Nine out of ten boys who come in for stealing tell me quite frankly that they "crooked" to get money to go to the "movies." The right or wrong of a dishonest act seldom enters into their minds. It is astonishing how little they are guided by the old principles of honor and integrity and how lightly the disgrace of thieving touches them. In discussing this many have said to me in all seriousness, "Why should I be

honest? Why should I work to earn money when I can get it so much easier by crooking?"

To supplant the wrong ideal of the "slick guy who steals and gets away with it," I endeavor to create a different hero for the boy to imitate. Too many have the notion that success in life depends on luck or on some distinction of class or fortune. The invaluable aid of the slides from the Museum cannot be overstated in this connection. Such sets as "Through the Brazilian Wilderness with Colonel Roosevelt," "The Search for Crocker Land," and "Climbing Mont Blanc," thrill the boy with real admiration for the right kind of heroism—courage, fortitude, and self-control—and help him to appreciate the truth of the following lines, which I often write on the blackboard:

You will find that luck
Is only pluck
To try things over and over;
Patience and skill,
Courage and will,
Are the four leaves of luck's clover.

The sets of slides which show the life of men and boys engaged in great industries, such as agriculture and lumbering, seem especially attractive to some of our boys, who remark on the unlimited spaces of the prairie and the forest. I often make the point that too many people crowd into the congested city instead of choosing a vocation which takes them into the country.

The faithfulness of the Eskimo dog makes a strong appeal to spoiled children, who are especially impressed with the fact that these dogs rarely cry or whine for food, knowing if their master has it, they will get it.

Our girls present problems of their own, and it is in the afternoon talks, when I meet them by themselves, that we discover where the emphasis

needs to be placed. My first task is to divert their burdened minds and bring their emotions under control. One afternoon a large girl, whom we shall call Olga, came in weeping violently. Her home and her mother had failed her in her hour of need. What did she care about *school* when she was learning the hardest lessons in the school of life? Bitterness, revenge, despair had taken possession of her soul, and she refused to be calmed. Just then a wee child whose home had been disrupted by the violent death of her mother was brought into the schoolroom in the hope that there she would find something to comfort her lonely little heart. As the big tears were rolling down the little one's cheeks, I led her to Olga saying, "Look at this heartbroken baby! Couldn't you take her into your nice big lap and cuddle her a bit?" Without hesitation Olga folded the little one in her arms, and smiling down at her through her own tears, she "mothered" the child until she had her fast asleep. Sunshine had dispelled the dark, angry clouds that fitful April afternoon and the rain had ceased to fall. Olga had learned to "look out, not in," and "lend a hand."

One of the most difficult lessons for our girls to learn is to live together without quarrelling, differences in race or in religion forming a never-ending source of dissension. Many are brought up in an atmosphere of perpetual conflict. To "agree to disagree" and be pleasant about it, seems to be a new doctrine to many. I have many stories from real life to impress the point, which I tell in detail. The following is the gist of one of these:

A farmer and his wife who had separated received little sympathy from their friends when it developed that the whole trouble arose from a

difference of opinion regarding which of two holes in the kitchen floor a mouse had run into. A reconciliation was effected, the couple lived happily—not ever after—but until months later while laughing together over their previous foolishness, one of them started the whole quarrel over again by remarking, "But, my dear, you must admit that I was right." The separation was permanent this time, and the deserted house became a laughingstock to all passers-by.

"Agree to differ, resolve to love," has a new meaning when the girls see the point of this story, and often when a quarrel begins among themselves some peacemaker is sure to remark with a smile, "Forget it. Who cares which hole the mouse went down?"

I find that the girls returning to their homes carry this story with them and report to me later that it has had its part in smoothing out family quarrels.

The Museum slides prove valuable in helping our girls to get out of their warped, little lives and to obtain a proper perspective on their problems. The lure of the cheap show is very great, and from the false, shallow standards depicted there our girls often form their ideals in life. The following was composed by a girl of fourteen in answer to my suggestion that she write out her ambition in life:

"I should like most of all to be a millionaire's daughter and belong to society and have anything I wish for. And then when I get big, I want to be a toe-dancer and one of the Broadway stars and have everybody love me. I wish to marry a clown, a millionaire's son, so he could dance with me."

The study of natural history is a means of deepening character and of giving our girls a truer value of life. Contact with the marvelous handiwork

of nature refines and softens the coarse influences of a brutal environment. By means of the slides, in imagination at least, we can "creep reverently" through the November woods with Helen Hunt Jackson "watching all things lie down to sleep." We can thrill with the wonderful scenery of mountain and stream, clouds and sunsets, which thereafter forms a background for the appreciation of choice gems of literature. As one sweet girl, who has had her young life burdened in an unusual way, recently remarked, "We all love the slides because they help us to forget our troubles and teach us about so many things we never knew before. I just love that quotation now, 'The soul would have no rainbow if the eyes had no tears.'"

Mrs. Margaret Forster, our wonderful matron, is an ardent lover of nature, reflecting in the strength of her character and the beauty of her daily life the grandeur and charm of the New Hampshire mountains, where she spends her brief vacation period. As often as possible during the showing of the lantern slides, she slips into the schoolroom and frequently adds interesting stories of plant and animal life out of her own experience on her New England farm.

Sets of slides showing our insect enemies have proved a revelation to both boys and girls, strikingly teaching them the necessity for cleanliness and for waging eternal warfare against the fly and other household pests. After observing these slides with open-mouthed wonder, one large colored boy remarked with great emphasis: "They—learn—you—sense."

This article has dealt more with the intellectual influences, including nature study, utilized for the general cheer and uplift of the children. Handwork also

has a considerable part in our program. For lack of both space and equipment, however, this is limited in variety, and the making of reed baskets has proved most satisfactory in its results with the children.¹ It must be remembered that each pupil is usually detained in our Shelter only a few days, but this is long enough for him to learn something about the art of basket-making—at least enough to complete one well-made basket, which always causes him delight.

One of the most effective means I have found for helping the children to discover their individual defects of character and to strengthen them, is a system of so-called "squeak-cards." The idea grew out of a story I heard when I was a young teacher in a country school on the prairie. A farmer set a "green hand" to grease a squeaking wagon wheel. The fellow worked long and hard, rubbing grease over every visible part of the wheel. When the wagon was next used, the wheel squeaked worse than before, and it was only after the farmer had removed the wheel and shown him the axle that the man discovered that a little grease applied to the right spot made the wheel run smoothly.

"Find the squeak and grease it," became a maxim in my school work, and the "squeak box" naturally has become a favorite device in this class.

After I have told the story of the squeaks to the children, I give each of them an opportunity to take a card and write out his own weak points as he sees them. I tell the children that if they succeed in conquering any of their faults and will report to me later, I shall be pleased to hear from them and shall draw a red line on the card through the squeak. Of course,

the confidence of the children is never violated, but a few squeaks taken at random from the "squeak box" will illustrate in their own words what things the children have to overcome.

From boys:

"My squeaks are cursing at my mother and fighting with my sister at home."

"Going with bad company. I can't say no."

"I pick up cigarettes and smoke them and then throw them away."

"I would like to stop crooking. I take anything I see."

"I got the habit of shooting craps and hitching behind the freights."

"Always demanding money off my mother."

"Bum."

From girls:

"My squeaks are I think I know more than my father and mother. That is why I am here today. I hope I soon recover."

"I am crazy over every good-looking fellow I see."

"I will not cuss, spit on, or kick my sister any more."

"My squeaks are bad temper. I lack patience. In anger I say nasty words."

"Often I can't control myself from lying."

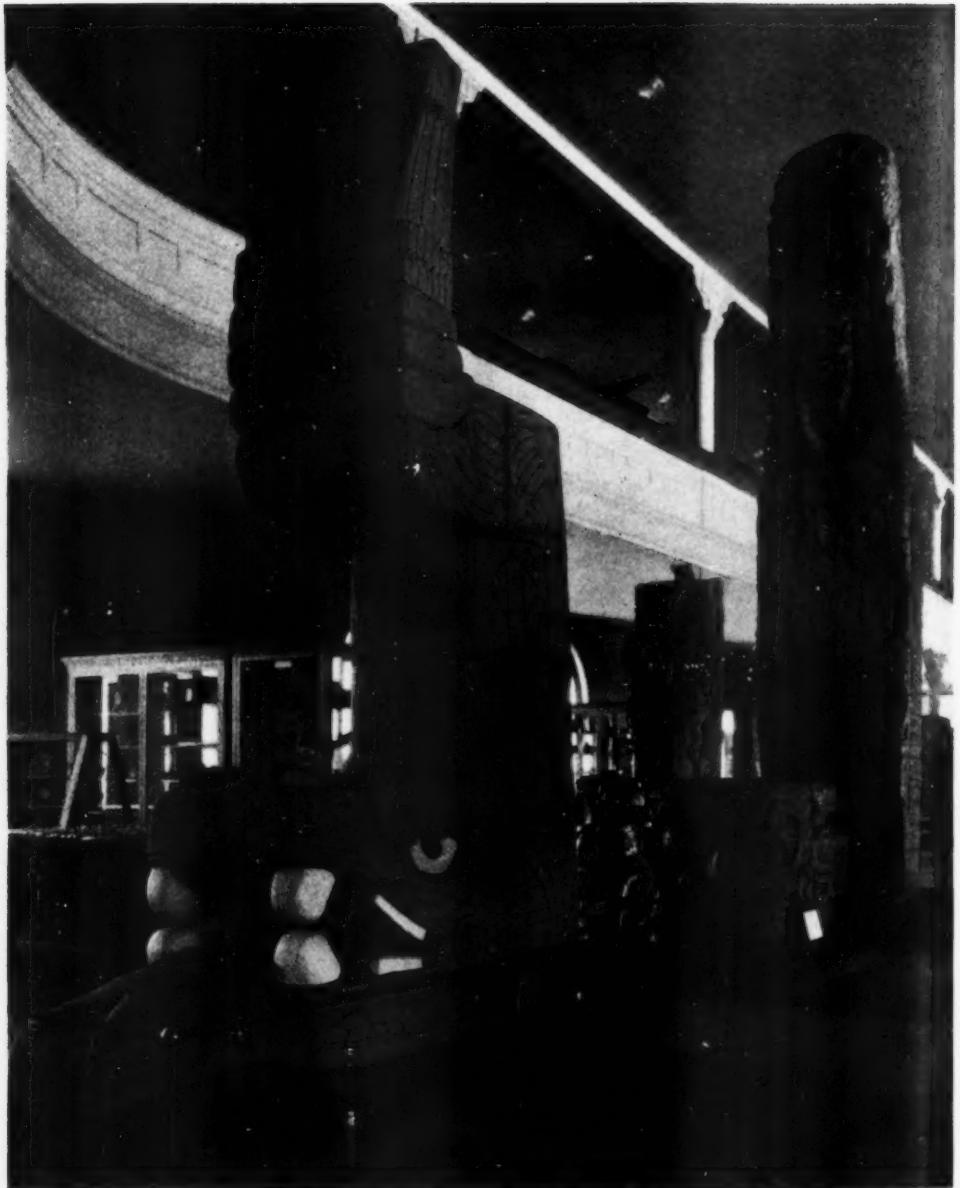
"Tattle tail."

I continue the use of the "squeak box" because I find that young people whom I have taught often come back to me or write testifying to its value in their lives.

"One down!"

This time it is the matron who calls. We are bidding good-by to the lad whose arrival a few days before was described at the beginning of this article. A warm handshake, a few words of advice, an invitation to come back to let us know how he is getting on, and the boy, neat, clean, and with his eye alight with hope and the determination to "make good," descends to the street. His case has been considered by the judge, who has brought to bear on the problem his many years of invaluable experience with juvenile delinquency, and the boy has been released on probation. An efficient probation officer has been assigned to see that he maintains a good record, and a Big Brother has volunteered to be his "guide, counselor, and friend."

¹Specimens of the children's handicraft were recently on exhibit at the American Museum. The reader is referred to *NATURAL HISTORY*, January-February, 1923, p. 96.



A SECTION OF THE HALL OF MEXICAN AND CENTRAL AMERICAN ARCHAEOLOGY,
AMERICAN MUSEUM

In the foreground is a reproduction of a sculptured column from the Temple of the Jaguars, Chichen Itza, Yucatan. The column represents a rattlesnake and is one of two that stood on either side of the doorway of the temple. The general coloration of the serpent is light green, the scales being outlined in red. Of a deeper red is the forked tongue and the mouth, in which the white teeth are conspicuous.

The original molds for this column were made in the field under the direction of Mr. Edward H. Thompson; the cast, including the restoration of the damaged parts, was made in the Museum by Mr. J. C. Bell

Man as a Museum Subject

BY CLARK WISSLER

Curator-in-Chief, Division of Anthropology, American Museum

FROM the very beginning the founders of the American Museum assumed that it was self-evident that a great natural history museum, to be complete, must include in its scope the natural history of man. Accordingly, even in the first years of the Museum's existence collections were acquired, by gift or otherwise, containing relics of the Stone Age and other primitive forms of culture. The gradual accumulation of museum materials in these ways ultimately led to the establishment of a distinct department under the name of anthropology. The curatorial responsibilities for this new department were delegated to Professor A. S. Bickmore, who was the originator of the movement that resulted in the erection of the Museum.

Professor Bickmore served as curator for eighteen years, and it was during this period that a number of the most distinctive collections were acquired. Among these were the Andrew Ellicott Douglass archaeological collection, which, with the Terry, Squire, and Jones collections, presents a representative series for the United States, the collections of Stuart, Robinson, and Feuardent, illustrative of palaeolithic and neolithic Europe, the Sturgis and Finch collections from the islands of the Pacific, the Emmons and Bishop collections made among the Indians of Alaska, and the collection of Squier, representing the ancient civilizations of Central America. Thus, when Professor Bickmore resigned as curator in 1891 that he might give his whole time to the educational work of the Museum, the foundation had been laid

for a comprehensive presentation of man's natural history.

A few years later Professor Frederic Ward Putnam, the new curator, organized the work of the department as we see it today, in which according to the problems presented and the method pursued, the activities of the staff fall under three heads, ethnology, archaeology, and racial anatomy. The responsibility for these subjects was divided among the personnel of the department, according to the special interests of the men involved.

As in the case of other departments of the Museum, the greatest progress came with field work and exploration, for it is by this means that new concrete facts are brought into the Museum's halls. Systematic work of this kind was inaugurated by Professor Putnam. Among the first of these enterprises was the Jesup North Pacific Expedition, which endeavored to determine the connection between man in the Old World and the New.

THE JESUP NORTH PACIFIC EXPEDITION

The Jesup Expedition, or rather series of expeditions, begun in 1897 through the munificence of the late Morris K. Jesup, constitutes one of the greatest of anthropological projects. The questions attacked were of cardinal significance, the scheme for their solution was carefully elaborated and was executed on a vast scale with all the resources of modern technique. Professor Franz Boas was in charge of the expedition and himself took part in the field work. Among his collaborators

were Doctor Bogoras and Doctor Jochelson, Doctor Laufer, and Doctor Sternberg in Siberia, Professor Farrand, Doctor Swanton, and Mr. Harlan I. Smith in America. The results thus far published in a series of sumptuous Museum *Memoirs* embody a wealth of important material, descriptive and interpretative.

The primary problem of the expedition was to determine whether there was any connection between the peoples of Asia and northwest America. This question was answered affirmatively as to race, language, and culture; that is to say, the so-called Palaeo-Siberians of northeasternmost Asia proved to form a unit with the aborigines of northwest America. Physically the latter display a stronger development of the Mongoloid eye and other Asiatic traits than do other New World natives, while they lack the pronounced nose that is so marked a feature of the American Indian physiognomy farther east. The tongues spoken by the ancient Siberians cannot indeed be regarded as belonging definitely to any one of the several linguistic stocks of aboriginal America, but morphologically they are distinctly nearer to the languages of the New World than to those of other Asiatics.

Culturally a variety of relations have been established between the peoples of the East and the West. The coastal Chukchi and Koryak closely resemble the Eskimo in their economic life, while their mythology betrays an old contact with the Indians of British Columbia that possibly antedates the arrival of the Eskimo in Alaska. The occurrence on both sides of the Pacific of a semi-subterranean house likewise constitutes a remarkable parallel.

While thus contributing materially to our knowledge of the history of the

American race, the work of the expedition also shed light on the general problem whether cultural likeness shall be interpreted as the result of independent development due to the similarity of human psychology throughout the world, or whether resemblances may be explained as the effects of contact and borrowing. It was shown conclusively that many of the parallels are intelligible only as products of diffusion from a common source. This general inference has certain significant theoretical implications. For example, it was commonly assumed by writers on primitive society that all peoples necessarily passed through a stage antecedent to that of the family organization, the place of the family being taken by the clan. But the researches of the Jesup Expedition showed that in not a few cases this order is reversed, inland tribes of British Columbia, formerly organized into families, having encountered the clan system of the coastal peoples and adopted it secondarily. Finally, the Jesup Expedition not only paved the way for highly important scientific conclusions but contributed enormously to the Museum's collection of ethnographic material, which as regards northeast Siberia is doubtless superior to any other in the country.

EXPLORATIONS IN PREHISTORIC AMERICA

Likewise under the curatorship of Professor Putnam and almost simultaneously with the organization of the Jesup Expedition, there was projected the B. T. B. Hyde Expedition to explore the cliff houses of Utah and uncover the ruins of Pueblo Bonito in Chaco Cañon, New Mexico. In 1897 work was begun upon the Bonito ruin, a magnificent communal house, a



TRANSPORTING ETHNOLOGICAL COLLECTIONS THROUGH SIBERIA

A reindeer train of twenty-five sledges was required to convey to the coast the collections made among the natives of Siberia by Dr. Waldemar Jochelson in the course of the Jesup North Pacific Expedition of 1902. This photograph shows a portion of the sledge train crossing the southern forested slope of the Verkhojansk Ridge in the province of Yakutsk, Siberia

portion of which was still standing. Parts of this ruin proved a veritable storehouse of turquoise ornaments. Thousands of beads were found, some so small that one can scarcely conceive how they could have been fashioned and drilled with the tools at the command of the ancient inhabitants. There were other rooms containing vast stores of pottery, some of unusual form. These collections were brought to the Museum, where the finest were placed on exhibition. At about the same time startling discoveries were made in the cañons of Utah, where cliff houses were found belonging to a period when no pottery was made. These are evidently remains of a much earlier age than the large pottery-bearing ruins of the Bonito type.

The early work of the American Museum in the rich archaeological field of Mexico and Central America, where the highest ancient civilizations of the New World were developed, was made possible through the generous support of the Duc de Loubat. In 1896 a concession was obtained from the Mexican Government under which excavations were carried on at Mitla, Monte Alban, Xoco, Guiaroo, Xochicalco, and other sites, resulting in fine archaeological collections. This general work was continued until 1903 under the direction of Dr. M. H. Saville.

Invaluable archaeological and ethnological collections were secured by the successive expeditions of Dr. Carl Lumholtz during 1892-1900. The most intensive work of these expeditions was among the Tarahumare, Huichol, and Tarascan Indians of the Sierra Madre Mountains.¹ The textile art of the Huichol is of the greatest value to modern students of design.

¹The reader is referred to the article by Doctor Lumholtz entitled "My Life of Exploration," NATURAL HISTORY, May-June, 1921, pp. 224-43.

In the expedition of 1894 to Copan, a great Mayan city in western Honduras, and in the field work in Guatemala under Dr. Eduard Seler of Berlin, the American Museum coöperated with the Peabody Museum of Harvard University.

Since 1909 the anthropological work in Mexico and Central America has been limited to exploring expeditions made by Dr. Herbert J. Spinden and Mr. Clarence L. Hay. These expeditions have resulted in the gathering of much data on the ancient civilizations as well as in important archaeological and ethnological collections. In 1909 and 1910 many of the ancient sites in central and southern Mexico were visited and important stratigraphic studies were made at Atzcapotzaleo where the remains of Archaic, Toltec, and Aztec cultures were found in superimposed layers. In 1912-13 and in 1914 exploration was carried on among the ruined cities of the Mayas in Guatema'a and Honduras, including Copan, Quirigua, Tikal, Ixkun, Seibal, Yaxchilan, and Piedras Negras.

During these years the horizon of the Archaic culture was greatly extended to the south, first to Salvador and Costa Rica and then across northern South America and down the western coast to Peru. It was correlated with the establishment and spread of agriculture from a center on the highlands of Mexico or Central America. Studies made at the ancient ruined cities of the Mayas, in coöperation with Mr. S. G. Morley of the Carnegie Institution, resulted in the discovery of new monuments and in the dating of many old ones. Both the sculpture and the architecture of the Mayas were shown to pass through historical developments. More recently, in 1917 and 1918, ethnological collections were

made in Guatemala, Salvador, Honduras, Nicaragua, and Panama. Especially noteworthy was the material obtained in Guatemala, consisting of textiles and costumes, the designs and construction of which are rich in valuable suggestions for students of industrial art. The Sumu and Mosquito Indians of Nicaragua were visited as well as the Valiente Indians of Panama.

As the combined results of these several explorations in the deserts and jungles of ancient America, the Museum possesses rich collections and from them has installed an entire hall, the Loubat Hall. Conspicuous in this exhibit are the casts of great monuments and sacrificial stones bearing hieroglyphic inscriptions and dates. The Museum has also been fortunate in securing the deposit of the collection of Mr. Minor C. Keith that represents the pottery, stone work, and gold work of Costa Rica.

TEXTILES AND POTTERY FROM PERU

Turning now to South America, we note that the Museum's prehistoric Peruvian collection was begun as far back as 1874 when the Edwin H. Davis collection was purchased. During the next year (1875) the rare collection formed by E. George Squier during his several years of sojourn and travel in Peru was acquired. This was a most important addition, as many of the specimens are figured and described in his well-known work *Incidents of Travel and Exploration in the Land of the Incas*. Following this no very important additions were made until 1892 when Adolph Francis Bandelier went to Peru, in which country and in Bolivia he continued collecting for the next ten years. The expenses for the first two years were defrayed by the late Henry Villard, who presented the large

collections made during this time to the Museum. The services of Mr. Bandelier were then taken over by the Museum and his work continued under its auspices for the next eight years. Mr. Bandelier's ten years' work so increased the Peruvian and Bolivian collection of the Museum that it is now one of the largest and most representative in the world.

Among other important accessions are the famous Garcés collection from the Island of Titicaca, the Gaffron collection from Nazca, and the Montero collection from Ica. Notable objects in the collections are sixty trephined skulls, including the "Squier skull," from the Yucay valley, which was the one that first revealed to the scientific world the fact that this difficult surgical operation was successfully performed in Peru in prehistoric times. The "Squier skull" has probably appeared, as an illustration, in more books and papers than any other object in the Museum.

The beautiful shawl-like garments from Ica and the unique polychrome pottery from Nazca attract general attention and furnish an endless number of suggestive motives for the designer and art student. The collection of textiles is a very large one. Almost every technique known was employed by the ancient Peruvians, and many of the pieces are very beautiful even when judged by modern standards of art; while the textile expert is astonished at the quality of the yarns and the evidences of skill on the part of the weaver. A number of such experts who from time to time have examined some of the finer pieces in this collection declare that from a technical point of view they have never been equaled. This collection constitutes the specific source from which come the inspiration



A SIOUX INDIAN

The standards of excellence and accuracy in the modeling of museum figures to present the distinctive races of men have risen to a high level. The photograph shows a Sioux man in the costume of a war leader. The figure of the man was first modeled in clay by Mr. F. F. Hortscher according to anatomical measurements for the tribe, but to give it individuality, portrait studies of a single Indian were used for the face and the pose. When complete, the modeled figure was cast in plaster. Mr. Frederick H. Stoll then gave it a dressing of wax and color to resemble skin. He was able to impart to it a lifelike appearance by using color studies of this particular tribe and of the individual represented. Lastly, a costume and equipment were selected from the Museum's Sioux collection and the figure was dressed.

and the suggestion that underlie the recent tendency to develop a national type of art. This movement is in a large measure due to Mr. Charles W. Mead, aided by his former student, Mr. M. D. C. Crawford. Many professional designers spend days in the Museum studying the remarkable textiles in the collection. The variety of form and elegance of technique found in these textiles make them an almost inexhaustible source of inspiration.

In addition to the regions mentioned, other parts of the South American continent have been visited by collectors on behalf of the Museum so that there are housed within its walls extensive collections from Guiana, from the Amazon basin, from Chile, and from Tierra del Fuego.

INDIAN TRIBES OF THE UNITED STATES

Work among the western Indians of the United States did not begin until about the year 1900. Previous to that date there were no collections in this Museum representing the culture of even a single tribe of the buffalohunting Indians, such as the Sioux, Comanche, Cheyenne, Blackfoot, Crow, etc. The first systematic collections were made by Dr. A. L. Kroeber among the Arapaho. Intensive collecting was begun about 1905 and carried on vigorously for six years. During this time practically every Plains tribe was visited, to the end that the Museum might have a comprehensive collection, presenting the most important phases of Indian life. Particularly rich is the series of beaded and otherwise decorated objects, offering great variety of design and of color combination. Students of art and design have been making new discoveries in the course of their examination of this material. In fact, no collection of equal size seems

to offer such boundless opportunities for investigation and exploitation. Great discoveries in the evolution of art and in the prehistory of our continent still await the assiduous explorer within the Museum itself.

With this wealth of material is a full collection of notes. Many important objects in the cases have their intimate personal histories carefully recorded by a museum man and placed on file. Here will be found data as to how beadwork was done, how moccasins were made, how feather bonnets were fashioned, and similar accounts, together with much valuable information as to the beliefs and fancies of the Indian. To secure all this intimate information the members of the staff lived for brief intervals with the Indians, making notes and observations and often receiving intensive instructions from old sages as to the Indian's philosophy of life and the homely ways of his fathers. Sometimes life friendships have sprung up in this way. Many Indians have taken a deep interest in the work and have shown much enthusiasm over the perpetuation of their past in a great scientific institution. An old Indian once said to the writer, "Now I pass in peace. You have written down our history; you have put away in a safe place the things of the old people. Our grandchildren can read and see what their ancestors did. Otherwise all would be lost. It is good that you came before it was too late."

Collecting among the Indians of the Plains is practically ended. In a few years the subject will be a closed book, to be read only in libraries or in the collections of museums. This work on the part of the Museum covered a period of less than fifteen years, occupied but a small part of the time of its anthropological staff, and the cost was



A SCENE AT THE FAMOUS PUEBLO RUIN NEAR AZTEC, NEW MEXICO
This large prehistoric ruin was excavated by the American Museum, the undertaking covering a period of six years. The study of the archaeological objects unearthed will require several years for its completion. This exhaustive research was undertaken at the suggestion of Mr. Archer M. Huntington, the site being purchased by him and recently donated to the United States as a national monument and park

insignificant. In addition to obtaining collections the department of anthropology prepared a comprehensive series of publications regarding these Indians, all of which will stand as substantial contributions to the subject.

THE ARCHER M. HUNTINGTON SURVEY
OF THE SOUTHWEST

In 1909 Mr. Archer M. Huntington offered to finance a survey of the living and of the prehistoric peoples of the Southwest. Accordingly, the curator of the department organized a series of investigations that were in continuous operation until 1922. Field studies were made among the Rio Grande Pueblo peoples, the Hopi, the Zuñi, the Apache, and the Navajo. At the same time work was begun upon the prehistoric ruins in three areas: (1) the valley of the San Juan River in northern New Mexico, and parts of Colorado, Utah, and Arizona; (2) the valley of the Rio Grande in New Mexico; and (3) in the basin of the Little Colorado in Arizona. The most prolonged and intensive work was in the area first named where efforts were concentrated upon the very large and hitherto unexplored ruin near the town of Aztec, New Mexico. Under the immediate direction of Mr. Earl H. Morris this large ruin was uncovered and partially restored. The return in collections has been rich. During the current year the Museum, with Mr. Huntington's generous assistance, purchased this ruin from the owner of the land upon which it stood and tendered it to the United States. The gift was accepted and by proclamation of President Harding the area was declared a national monument.

Some idea of the magnitude of the archaeological part of the Huntington

Survey may be gathered from the fact that 1530 sites and ruins were studied, covering an area of more than 50,000 square miles. This survey certainly ranks as one of the great archaeological undertakings of our time.

SEEKING THE TIME CLOCK OF PRE-HISTORIC AMERICA

About ten years ago the department of anthropology set out to find clues to the time sequence of cultures in ancient America. The question in its simplest form is: what is old and what is recent? Though at first thought this question may seem easy to answer, it is, as a matter of fact, one of the most baffling known to science. So far as the problem applies to the Southwest, it was made one of the objectives of the Archer M. Huntington Survey. Associate Curator Nelson found superimposed deposits of refuse about the ruins in New Mexico, from the pottery in which a time scale could be devised for that area. We can now say whether a given type of pottery is older or more recent than another. This method was applied to other districts by Messrs. Spier and Morris. Combining the results thus obtained with those of other investigators, we can now draw up the general outline of history in the Southwest from a remote simple culture without pottery or agriculture down to the higher cultures of the Hopi and Zuñi Indians of the present.

A number of years ago, under the curatorship of Prof. Frederic W. Putnam, search was made for traces of glacial man in the vicinity of Trenton. At that time it was established that there were at least two periods of occupation on the famous Abbott Farm, the earlier of which is frequently spoken of as argillite culture, a simple Stone Age civilization. The collections

made under the direction of Professor Putnam were brought to the American Museum. Later, under the present curator of the department, further investigation of the site was undertaken, with the result that it was shown that the argillite culture was contemporaneous with the sand deposit in which it occurs. While it is still impossible to assign an exact date to this deposit, it seems to fall not later than the period of receding glaciers.

Supplementary to these investigations, Mr. Nelson examined shell heaps on the south Atlantic coast and also deposits in the Mammoth Cave region of Kentucky, finding in each case evidences of successive occupation, pointing to an early period represented by non-agricultural tribes without pottery. Doctor Spinden found stratified deposits in Mexico which revealed an old underlying culture, traces of which are found in the adjacent parts of both North and South America.

These accomplishments, taken in connection with the important additions to knowledge made by investigators representing other institutions, mark the opening of a new era in the study of man in the New World. We are now about to date the achievements of the aborigines and so bring the history of the New World in line with that of the Old.

THE ROLL OF EXPLORERS

The exploration projects briefly reviewed in the preceding pages could have been greatly expanded by the inclusion of minor and special undertakings, such as collecting trips in the Arctic, in the heart of Africa, Polynesia, and Asia. Although more detailed reference to these is omitted for considerations of space, no presentation of the expeditions of the department

would be adequate without mention of the many men who have shown so unreservedly their zeal and enthusiasm for exploration and research. In addition to the present staff of the department, there is a long list, among which appear the names of many distinguished anthropologists, including:

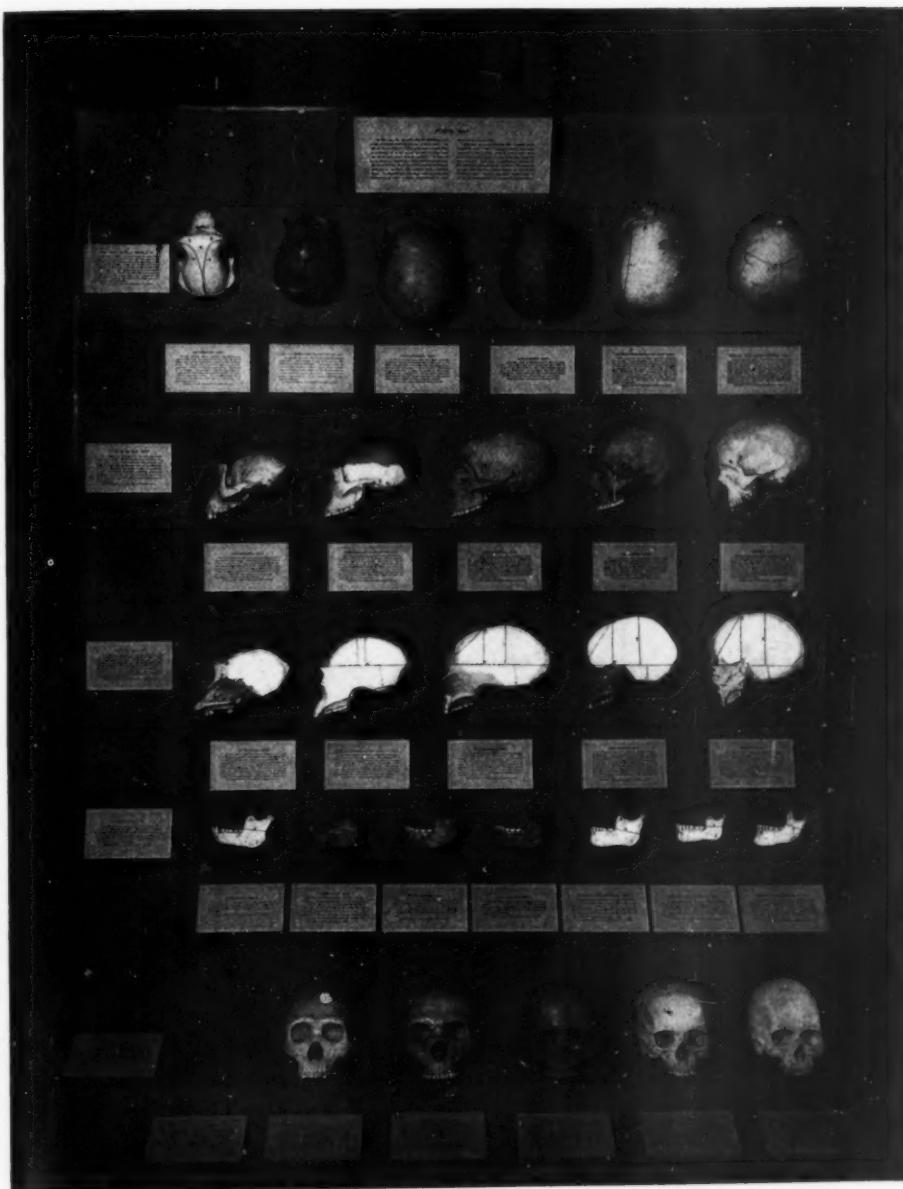
A. F. Bandelier	Robert H. Lowie
Franz Boas	Earl H. Morris
Waldemar Bogoras	Frederic Ward Putnam
George Comer	George H. Pepper
Roland B. Dixon	Edward Sapir
G. T. Emmons	Marshall H. Saville
Livingston Farrand	Alanson Skinner
Gerard Fowke	Harlan I. Smith
Waldemar Jochelson	Frank G. Speck
William Jones	Leslie Spier
M. R. Harrington	Herbert J. Spinden
A. Hrdlička	V. Stefansson
M. L. Kissell	J. R. Swanton
A. L. Kroeber	Ernest Volk
Berthold Laufer	J. R. Walker
Carl Lumholtz	Gilbert L. Wilson

To these could be added the names of many others who have made special collections for us in lands all over the world.

THE EXHIBITS

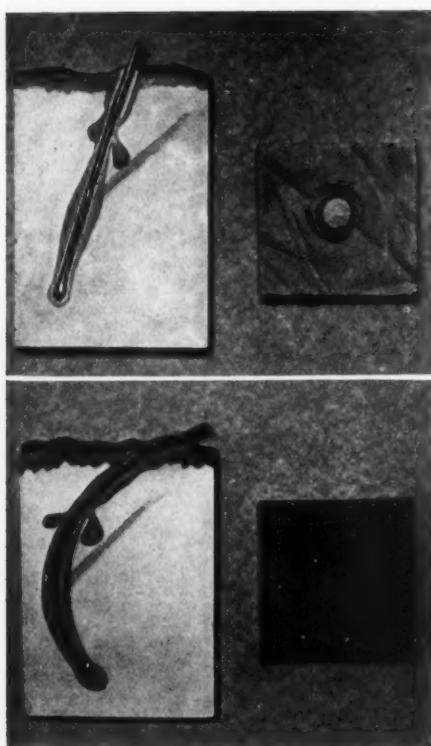
The expeditions of the department are undertaken with the object of obtaining materials and data to be used in the preparation of exhibits. To make these exhibits effective and authentic it is essential that duly qualified men visit the out-of-the-way places of the earth and lay in a store of scientific material. As the department grew it became clear that its policy should be to prepare special exhibits from carefully selected material in its reserve stock. In consequence, about the year 1907, the collections were reorganized under two heads, exhibition material and the study series.

Of the twelve exhibition halls occupied by the department eight are



FOSSIL MAN EXHIBIT

In this exhibit replicas of the skulls and jaws of early types of man are so arranged as to be readily compared with the corresponding parts of an anthropoid ape on the one hand and with those of modern man on the other. In the top row from left to right, the skulls are those of an anthropoid ape, of *Pithecanthropus*, of Neanderthal man, of Crô-Magnon man, and of the modern long-headed and short-headed types. This order of arrangement applies also to the next two rows, except that modern man, instead of being represented by two types of skull, is indicated by only a single example. In the fourth row from the top material is offered for a comparative study of the human jaw at different stages of evolution. The reduction in size of the bony framework of the face becomes apparent as the eye traverses the bottom row from left to right, viewing successively *Pithecanthropus*, Neanderthal man, Crô-Magnon man, the Negroid type of modern man, and the European type of modern man.



Racial differences manifest themselves even in the form and structure of the hair. The straight hair characteristic of Indians and Mongolians is straight in the hair-sac (upper left) and circular in cross section (upper right); the woolly hair of Negroid peoples is sharply curved in the hair-sac (lower left) and oval in cross section (lower right). European hair, usually wavy, is of intermediate type. These wax models of hair, highly magnified, were prepared by Mr. Shoichi Ichikawa.

devoted entirely, and two mainly, to living peoples. Four of these eight halls are concerned with North America, one with Africa, one with Asia, one with Malaysia and the Philippines, and one with the Pacific Islands. The general arrangement of these halls is geographical; that is, primarily by large culture areas and secondarily by tribes or islands. The objects from any one tribe are grouped in the cases according to subject; those illustrating art, for instance, are separated from

those illustrating household utensils and ceremonial objects. By means of indexed labels, maps, and diagrams the student visitor is quickly able to locate any particular type of specimen from any desired region or tribe. For the benefit of visitors whose interest is more general, each hall as a unit is arranged to produce a lasting and definite impression. The spacious canoe, the totem poles, and the material in the cases of the North Pacific hall, for example, give unescapable evidence of skillful work in wood and bark and of a grotesque conventionalized art. Mural decorations and groups representing the industrial and ceremonial life of the people are being provided to supplement the displayed collections.

Two of the remaining halls, or exhibition units, are devoted to the ancient civilizations of Mexico and of Peru. A third hall presents a synoptic series of man's handiwork from the earliest Stone Age in Europe to the dawn of history. Supplementary to this story of man's upward trend in industry and art is a section showing his racial characteristics and his biological history.

The material in the second division of the collections, the study series, greatly exceeding in bulk the total number of objects displayed in the halls, is preserved with great care in storerooms. The specimens are so arranged and classified on metal shelving, or in trays, that any specimen desired can be found quickly. This wealth of permanently preserved material is being constantly used by our own staff, by graduate students from the universities, and by visitors interested especially in ethnology, design, art, etc.

During the past few years the chief concern of the department has been to emphasize the salient features of the

exhibits and to improve the technique for habitat groups, as evidenced in the Apache, Hopi, and Navajo sections. The groups mentioned are constructed to natural scale, with painted backgrounds, and are based on careful field studies by Messrs. Young and McCormick. In technique and boldness of execution they set a new standard in museum groups embodying human figures.

Finally mention may be made of a series of small booklets introducing the visitor to the important problems presented by these groups and special exhibits. It is the hope of the present staff that ere long the halls of the Mu-

seum given over to anthropology may present in their arrangement a comprehensive view of man's origin and of the slow and laborious development of his culture throughout the vista of prehistoric time, that these halls may also be rich in detail, presenting geographical and racial types of human life, so that the visitor may, if so inclined, realize by repeated visits to the Museum, the relation of man to the earth and the intimate relation that exists between him and the environment in which he chooses to live. It is thus that the exhibits in anthropology reveal the natural history of man.



The ethnological laboratory.—Specimens illustrating the arts and mode of life among the tribes investigated by the Museum staff or visited by explorers are stored in specially constructed vaults on the attic floor of the anthropological wing and adjoining these vaults is a small laboratory into which collections can be taken for study. The photograph shows Dr. Waldemar Jochelson, a distinguished Russian ethnologist, on the right and Mr. C. M. Barbeau, of the Anthropological Division, Canadian Geological Survey, specialist in Indian languages and folklore, on the left, both making detailed studies of collections in their special fields



THE MARKET PLACE AT CHALCHIHUITES

The Buried Past of Mexico

OPPORTUNITIES FOR ARCHAEOLOGICAL WORK IN THE CENTRAL AND NORTHERN PARTS OF THE REPUBLIC

By CLARENCE L. HAY

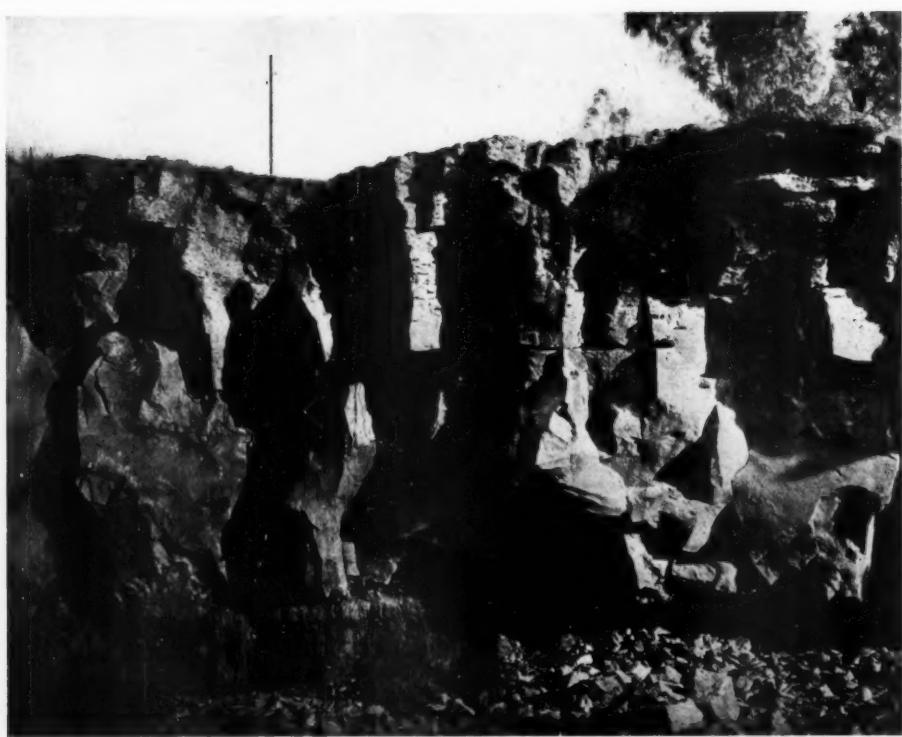
Research Associate in Mexican and Central American Archaeology, American Museum

MEXICO is a very dangerous country for the American traveler. It leads him into the perilous habit of prophecy. If he has been in that land two weeks, he writes an article; if his sojourn has been prolonged to a month, he writes a book. I confess upon the occasion of one visit to have written a political forecast, but it was never published, for before I reached home the entire situation had changed. Now, whenever I return, and am asked the invariable question: "What is going to happen down there; how is the situation going to work out?" I fall back upon an answer once given me by an erudite observer, "You can dope the situation out thirteen ways, and the fourteenth will happen!"

There is, however, a field which is unaffected by the kaleidoscopic changes of conditions in that unhappy country. The revolutions which sweep down from the north lay waste the surface of the land and flood the mines, but leave unharmed the scarcely hidden wealth which awaits the pick and shovel of the archaeologist. In the midst of all the political unrest since the fall of Diaz, the archaeological branch of the government has blossomed and has borne fruit.

The stores are so widespread that it is difficult to decide which regions to emphasize. I shall not consider the wonderful Mayan or Zapotecan country of the south, but will confine this article to the highlands of Mexico and to the less explored fields in the east, west, and north.

The Valley of Mexico alone, with the great age of its deposits, and the evident cross-currents of cultures, offers many problems which may not be solved in the present generation. Possibly the most fascinating remains, though the least spectacular of all, are those of a primitive culture which, for want of a better name, has been called the "Archaic," and of which the richest finds have been made in the outskirts of Mexico City. For several years past, the Mexican government has been conducting a most interesting exploration of an Archaic site at San Angel, a southern suburb of the city. Excavations have been made at a quarry, on the edge of an ancient lava flow, which occurred, geologists variously estimate, from two thousand to ten thousand years ago. The volcanic stone is from fifteen to thirty feet in thickness, and on top are found articles belonging to the Aztec civilization. Beneath the great cap of lava tunnels were made, and objects of the Archaic type were found therein. These consist of stone utensils, pottery vessels, figurines of baked clay, quantities of potsherds, and several skeletons, the latter apparently from burials. This discovery is a most valuable contribution to science, as it establishes beyond question the relative age of the Archaic type, which is found here unmixed and undisturbed. The deposit of lava is very extensive, and the Mexican government would welcome scientific excavations made at other points on the edges of the flow.



A lava-quarry site at San Angel, near Mexico City. The earth stratum in which Archaic remains are found is clearly seen at the bottom of this picture. Aztec remains are found on top of the lava. Courtesy of Dr. Manuel Gamio



A skeleton belonging to the Archaic period, obtained from a stratum of earth that had been covered by a lava flow at some time subsequent to the burial. Courtesy of Dr. Manuel Gamio

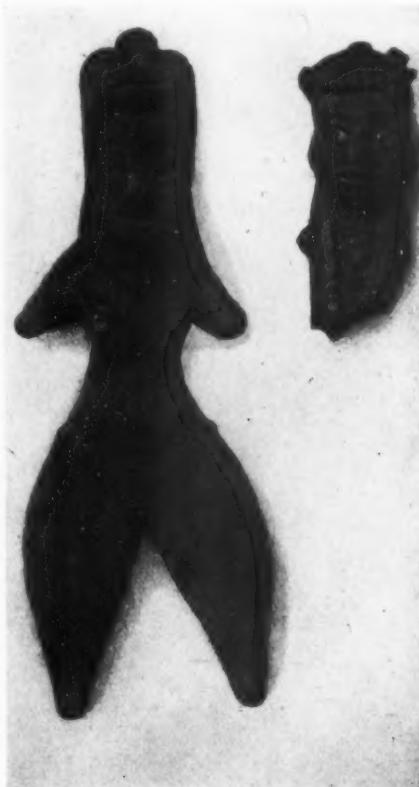
There is another volcanic deposit on the other side of Ajusco Mountain, running toward Cuernavaca, in the state of Morelos, and it would be interesting to discover if the culture to be found beneath this flow is identical with that found at San Angel. It is noteworthy that pottery resembling the Mexican Valley Archaic has been found in many parts of Morelos, as well as in the adjoining state of Puebla.

The land about Atzcapotzalco, a little to the northwest of Mexico City, is especially abundant in archaeological remains. There the excavator is rewarded by finding three distinct cultures, superimposed and varying in relative depth according to the site chosen. At one place the writer found near the surface of the ground objects of the Aztec type, and at a depth of from three to eight feet, specimens of the Teotihuacan or Toltec type, while it was necessary to continue to the depth of from ten to twelve feet to find Archaic specimens, which were similar in every particular to the objects found under the quarries at San Angel.

On many of the hills surrounding the Valley of Mexico, this same Archaic type is found at, or near, the surface of the ground. It has not yet been established whether these surface finds represent a survival of the Archaic culture, or whether they were deposited at the same time as those in the valley, and escaped being deeply covered, as the valley objects were, by erosion from the hills.

A classification of the Archaic is difficult, owing to the wide variety of types of the anthropomorphic figurines. No two are exactly alike. They are the work of the savage, groping for self-expression in art, and though many of the images are grotesquely crude, some of them—particularly in respect to the

heads—are surprisingly well executed, and indicate a long process of development. It would not be surprising, therefore, to discover in some lower strata a "pre-Archaic" of still cruder form, antedating anything hitherto found. In short, this fundamental culture presents the most important, and the most puzzling, of all the archaeological problems of Mexico; and it is with the object of eventually working out a solution that intensive studies should be made in all parts of the republic.



These figurines of Archaic type were obtained from water-bearing gravels at Atzcapotzalco, near Mexico City. The one on the left is a specimen of unusual character that finds place in the collection of the American Museum. That on the right is reproduced from the collection of the author.



These Archaic types from the Valley of Mexico indicate an interesting range in portraiture; facial proportions, features, and headdress differing from individual to individual. They are part of the collection in the Museum of the American Indian—Heye Foundation.

There is much primitive pottery in Central America, and some even in the United States, which suggests a common origin with the ancient type of the Valley of Mexico. Was it a primitive people that overran this continent from

the southern United States to northern South America, thousands of years ago, and laid the foundation for the higher civilizations which came after them? This can only be determined by the most painstaking comparisons, and much stratigraphic work in many parts of Mexico and in other countries. But a solution would be worth all the effort involved.

In museums throughout the world there are various pottery figures in human form that are of a distinct type. Collected from the states of Jalisco, Michoacán, Colima, Nayarit, and even from Zacatecas, they show considerable skill in modeling, and many of them seem to be portrait studies. They have been given arbitrarily the designation "Tarascan," though many of

them come from points outside of the historic Tarascan area. This is another alluring field for the archaeologist, not only on account of the artistic value of the objects found, but also because its investigation will help to clear up the



Statuettes from the "Tarascan" area, now in the American Museum. They differ so much in facial type and expression that they appear to be individual portraits

riddle of the Archaic. No scientific stratigraphic work has been done in this entire region, and as the figures are apparently a later development of the primitive Valley of Mexico type, excavations may reveal the true Valley culture underlying the "Tarascan."

A similar, though even more complex, situation exists on the east coast, in the Panuco region of the oil fields. From this part of the country comes a diverse assortment of clay figures of three general types: figurines in semi-relief, apparently made from a mold, and resembling certain small idols found in the Maya area in the south; well-made idols of pastillage technique; and a few distinctly resembling the Archaic of the Mexican highlands. As this region was populated by the Huastecas, an outlying Maya tribe, the Maya-like types are to be expected, but it is hard to determine the chronological position of the free-hand figures of the second type, which appear to



This figure, of late Archaic type, from the Peabody Museum in Cambridge, was collected by Mrs. Zelia Nuttall in the Panuco region. Figures are frequently found on the surface of the ground after a heavy rain



The plaza of San Juan de Teotihuacán is surmounted by small truncated pyramids with stairways giving access to them. The Pyramid of the Moon is seen as a dark mound against the hill in the background on the left of the center of the panorama; the Pyramid of the Sun is on the right of the center

be of a later date, and the Valley of Mexico Archaic, which may or may not be the earliest. Farther down the coast, the Totonacan area in the central part of Vera Cruz shows characteristics of both the Maya and the Archaic, and a careful study will be necessary to determine the relation of the two cultures.

To those who believe that Mexico is a land now inhabited chiefly by "grafting" generals on the one hand and bandits on the other, nothing is more instructive than a glance at the work recently accomplished by the government under the able direction of Dr. Manuel Gamio, of the Departamento de Agricultura y Fomento, at San Juan de Teotihuacán. This ancient Toltec city, which can be reached within an hour by train or automobile from the capital, has for long been one of the well-known attractions of Mexico. The Pyramid of the Sun, about 180 feet in height, is

the largest of its monuments,¹ and was restored under Porfirio Diaz. The Pyramid of the Moon, which is somewhat smaller, has not as yet been restored. These pyramids were built of adobe bricks, faced with stone and cement, and apparently were enlarged from time to time. Unlike those of Egypt, they contain no burial chambers. Originally there probably existed an altar on the flat summit of each, dedicated to its respective deity. In addition to a quantity of smaller mounds and buildings, there is another structure, third in point of size, but now first in point of interest, which has been known popularly as the "Citadel." To this group Mexican archæologists have been devoting their time for the past three years, with the most astonishing results.

The temple enclosure consists of a

¹There is a still larger pyramid at Cholula, in the state of Puebla. It is built of adobe, and was originally about two hundred feet in height. It is much greater in volume, though not as high as the pyramid of Cheops in Egypt.



The double structure on the right half of the panorama represents two periods in the history of San Juan de Teotihuacán,—the addition on the right, only partly freed of its covering of soil, being of later date than the exposed pyramid. This group is known as the "Citadel" and was probably erected to the god, Quetzalcoatl. Courtesy of Dr. A. V. Kidder

quadrangular plaza 160,000 square meters in area, its two principal axes oriented in the direction of the four cardinal points. It adjoins the "Pathway of the Dead," which leads to the two great pyramids. Each side surrounding the plaza is composed of a platform 400 meters long, 7 meters high, and 80 meters broad, surmounted by small truncated pyramids, which are connected with the platform and the plaza by stairways. There are four small pyramids on each side, except on the east, where there are but three. A stairway on the west side leads from the Pathway of the Dead to the top of the platform, and another takes one down into the plaza.

In the center of the quadrangle stands a double temple, which represents two epochs in the history of the city. It appears to have been erected to Quetzalcoatl, god of the winds. Excavations were begun on the western elevation, which proved to be a

later addition, representing the "period of decadence." It is higher than, but similar in construction to, the smaller structures on the platforms, and like them bears no decorative art. It had been attached to the older temple on top of the existing façade.¹ In this manner the builders of the second epoch buried, and unwittingly preserved for discovery a thousand years or more later, some of the finest sculptures ever unearthed on the American Continent. On the other sides of the older temple, which had been exposed to the elements and to the depredations of Christian builders of the Colonial Period, hardly a trace of the original facing remains.

On the older temple serpent heads in stone adorn either side of the stairway, and the entire side of the terraced pyramid is covered by rows of plumed

¹There is abundant evidence in other parts of the city of two epochs; floors, walls, and stairways of houses are frequently found beneath the ruins of other buildings.



In the upper picture is shown that portion of the "Citadel" that fronts the later and only partly excavated pyramid. Richness of ornamentation characterizes this well preserved side of the original temple. The character of the sculpture appears in full detail in the restoration (lower picture) where the head of the plumed serpent is seen alternating with that of another god, probably Tlaloc. Both of these pictures are reproduced by courtesy of Dr. Manuel Gamio

serpent heads, with representations of the head of another god (probably Tlaloc) alternating, while associated with them are the bodies of serpents in bas-relief, sculptured sea shells, and

other figures. Not only have most of the stone carvings on the façade been preserved, but many of the delicate shells, carved in stucco, remain intact. There are also many vestiges of the



The steps in the upper picture illustrate two periods of culture, evidences of which are found in various parts of the city of Teotihuacán. Inferiority in art and workmanship is apparent in the structures of the later period.

The frescoes on the masonry shown in the lower picture have been preserved to a remarkable degree. Some of the paints on excavation were still bright and the individual colors stand out with considerable sharpness. Courtesy of Dr. Manuel Gamio

polychromatic covering, and in several examples incrusted obsidian eyes are to be seen in the serpent heads.

Restoration was necessary in this group in order to preserve the exposed monuments from complete disintegra-

tion, and a certain amount of reconstruction was resorted to. This seems to have been conducted faithfully and scientifically, with the minimum amount of guesswork.

That part of the temple of Quetzal-



One of the largest Aztec mounds in the vicinity of Mexico City is shown in the upper picture; it awaits exploration by the archaeologist.

The lower picture is that of an Aztec pyramid located at Cuernavaca. Mexico abounds in monuments of this kind, which before their excavation seem to the casual observer to be merely small hills. Courtesy of Dr. Manuel Gamio

coatl which is standing today may have been the substructure of a temple, or may simply have been crowned by an altar. The same is true of the smaller buildings of this group. In any case, nothing remains to show what was on

the top, and no attempt has been made to erect a hypothetical superstructure. In every instance where reconstruction was practiced, there was a sufficient amount of the original façade remaining to indicate clearly the lines to follow.



From the top of the ancient fortress known as El Chapin in the vicinity of Chalchihuantes one looks upon the scene depicted in the photograph. This fortress was built on a prominent hill, isolated and admirably adapted for defense. Some of the walls are still standing.



The columns of one of the buildings—probably a temple structure—at Chalchihuantes. Originally these columns evidently supported a roof, but this roof has long since disappeared. The Chalchihuantes region offers exceptional opportunities to the archaeologist. Doctor Gamio has been excavating one of the sites but much still remains to be done in the area.

There appears to be a wing attached to the Pyramid of the Moon, and recently test tunnels were being dug, to discover whether a façade similar to that on the Temple of the Winds exists on the Moon Pyramid.

The Government at one time employed as many as four hundred workmen on the Quetzalcoatl group, but in spite of what has already been accomplished, there are a vast number of mounds in other parts of the city which

have not been touched, and the department of anthropology in Mexico would gladly offer facilities to the foreign archaeologist to excavate at Teotihuacán. There was obviously at one time a great population at that place, but as yet no burying ground has been discovered. Fortunate will be the man who finds this cemetery and the precious objects that lie buried with the countless dead!

Though the discoveries at Teotihuacán have overshadowed all other recent archaeological accomplishments, the Mexican government has not confined itself to this site alone. Some work has been done at various sites in the south of Mexico; work is being completed on a most interesting Aztec ruin at Cuernavaca in Morelos; Aztec temples have been brought to light in the City of Mexico itself, and in the environs, at San Bartolo Naucalpan and Mixcoac. Mexico has undertaken an important work in the restoration of the great ruins of Monte Alban in Oaxaca, and an Archaic pyramid, situated near Tlalpam in the Federal District, is being brought to light by Professor Byron Cummings of the University of Arizona, under the auspices of Doctor Gamio. Lava had flowed around the pyramid, partly covering the base of it. The pyramid is impressive in size, is of good, though crude, workmanship, and gives the Archaic people who undoubtedly built it, a position of great importance in Mexican archaeology. Plans are also being made for the restoration of Tajin, a temple of the Totonacan culture in the state of Vera Cruz, and of a group of ruins known as "La Quemada" in Zacatecas.

It would seem that I had exhausted the potential archaeological regions in Mexico, but this is by no means the case. There is much work to be done in

the central part of the republic, and to the north, in Durango and Chihuahua. La Quemada, in Zacatecas, which the government proposes to restore, is an important group of ruins of an undetermined culture, resembling the Toltec in architecture. Pottery has been found here which connects it also with the "Tarascan" civilization.

Associated with La Quemada, are the ruins of the Chalchihuites region in Zacatecas. This is a most important area and except for a site which was excavated by Doctor Gamio in 1908, the work being resumed by him in February of 1922, nothing has been done in all this territory. There is a ruin of the Chalchihuites type not far from Canutillo, Zacatecas, which must have been an impregnable fortress, standing as it does on an isolated rock, commanding an extensive stretch of country. It appears to be of greater consequence than the Chalchihuites ruin already excavated, and the work of clearing it would be far easier. Loose earth and other débris could simply be dumped over the edge of the rock to the plain below.

This is but one of legion. So far we know almost nothing of the nature of the many ruins farther north in Durango. In the neighborhood of Zape, for instance, there are remains which, when investigated, may prove to be the link between the cultures of Mexico and our own Southwest.

In northwestern Chihuahua is a great group of adobe ruins, now almost leveled to the ground by erosion. This group, known as "Casas Grandes," has lent its name to a type of pottery widely distributed in Chihuahua, which is affiliated with the Pueblo ware of the southwestern United States. These ceramics are justly celebrated for the beautiful and varied forms of the

vessels, and for the wealth of designs upon them, the colors of which have remained bright through the ages in which they have lain under ground.

The many mounds, which are known locally as "Montezumas," were formed by the fallen roofs and walls of the structures. The objects, which were buried with the dead, are found beneath the original floors.

No knowledge of archæology is required to discover the pottery, a fact which was confirmed by the amateur excavators of the Pershing expeditionary forces. As far as I am aware, however, there is available to science no record of a single complete exploration of a Montezuma. And there is no more delightful country to work in than northern Mexico.

I had occasion recently to make a trip in Mexico with Dr. A. V. Kidder, of Andover. We were everywhere treated with the utmost courtesy, at the hands of officials and people alike.

"Something hidden. Go and find it. Go and look behind the Ranges—
Something lost behind the Ranges. Lost and waiting for you. Go!"

We were particularly grateful to Dr. Manuel Gamio, director of anthropology, for the efforts which he made on our behalf. He personally took us to many of the most important monuments in the republic and was largely instrumental in making our journey a success. I must also mention the unfailing hospitality extended to us by our fellow Americans resident south of the Rio Grande.

The "secretaría" of anthropology has available a quantity of data to assist the archæologist in his pursuits. These include charts of the various regions, with the geographic situation of the remains; itineraries and means of access; and a list of the accomodations which may be obtained at, or near, the respective sites.

The foregoing outline may serve as a meager indication of the crying need for new men in this field. It is necessary to go to Mexico to gain any true understanding of the endless opportunities for research.



Archaic vase of the gourd type found by the author in the valley of Mexico



Photograph by Dr. P. J. S. Cramer

MONKEY GATHERING COCONUTS IN JAVA

These agile animals are trained to climb the coconut trees and detach the fruit. From below the owner of the monkey guides its actions by means of a long cord (not visible in the picture) that is attached to the creature before it is sent on its errand

Monkeys Trained as Harvesters

INSTANCES OF A PRACTICE EXTENDING FROM REMOTE TIMES
TO THE PRESENT

BY E. W. GUDGER

Associate in Ichthyology, American Museum

IN the issue of *Science* for February 7, 1919, I published a note entitled "On Monkeys Trained to Pick Coconuts," the opening paragraph of which read as follows: "Readers of the Sunday editions of some of our metropolitan papers may recall that in the fall, the season of cotton-picking in the South, waggish space writers sometimes make the suggestion that monkeys be trained to do this work and that thereby the shortage of labor be relieved." This statement was followed by quotations from the books of Miss Isabella Bird and of Mr. R. W. C. Shelford to show that in the East Indies monkeys are employed to pick coconuts for their masters.

Some quiet fun was made of me for having been "taken in" by these accounts, but the laugh passed to my side when Mr. Carl D. La Rue, writing from Kisaran, Asahan, Sumatra, published in the issue of *Science* for August 22, 1919, a note entitled "Monkeys as Coconut Pickers." In this he said:

"E. W. Gudger has recently called attention in *Science* to the use of monkeys as coconut pickers. The Malays and Bataks of Sumatra very commonly use monkeys in this way. The current English name for the monkey, *Macacus nemestrinus*, is 'coconut-monkey.' The work of picking the nuts is performed in a way essentially the same as that described by Shelford and quoted by Gudger.

"These monkeys not only work, but have a considerable commercial value as laborers. The price of a trained coconut monkey ranges from about

\$8.00 to \$20.00; a price far above that put upon other common sorts of monkeys which are kept only as pets.

"Coconut monkeys grow to a considerable size, and are very strong."

My friend, the late Dr. A. G. Mayor, became interested in my note in *Science* and told me that on one of his trips to the Pacific, he had met Dr. P. J. S. Cramer, director of the experiment station at Buitenzorg, Java, who had shown him photographs of the monkeys at work. A letter to Doctor Cramer brought the following courteous reply:

"I have the pleasure to enclose three photographs of a monkey picking coconuts. On the first you see him climbing up the stem, on the second sitting on a leaf, on the third stretching his hand out over a coconut. What you cannot see on the photographs is that the animal is attached to a thin cord, by means of which the owner governs his movements."

Since I wrote my note in *Science*, there has come to my attention, as the result of considerable reading, a number of similar accounts reaching back into remotest antiquity, and it has seemed worth while to bring all of these together, arranged in reverse chronological order, so that readers of NATURAL HISTORY may have available the record of this ancient but little-known example of coöperation between man and his fellow Primates.

First comes Shelford's account,¹ dated 1916 and worded as follows:

"*Macacus nemestrinus*, the pig-tailed Macaque, or Brok of the Malays, is a

¹Shelford, Robert W. C. *A Naturalist in Borneo*, London, 1916, p. 8.

highly intelligent animal, and Malays train them to pick coconuts. The modus operandi is as follows:—A cord is fastened round the monkey's waist, and it is led to a coconut palm which it rapidly climbs, it then lays hold of a nut, and if the owner judges the nut to be ripe for plucking he shouts to the monkey, which then twists the nut round and round till the stalk is broken and lets it fall to the ground; if the monkey catches hold of an unripe nut, the owner tugs the cord and the monkey tries another. I have seen a Brok act as a very efficient fruit-picker, although the use of the cord was dispensed with altogether, the monkey being guided by the tones and inflections of his master's voice."

One of the most important of scientific voyages of recent times is that of the "Siboga," sent out by the Dutch government to explore the waters of the East Indies in the years 1899–1900. Its leader was the distinguished naturalist, Dr. Max Weber. His wife accompanied him, and in her book¹ descriptive of the voyage we find this paragraph relative to our subject.

"In 1888, we lived there [at Manindjau in Sumatra] for a month in a Kampong house. Opposite us was a Malayan family which owned two Lampong, or Lapond, apes (*Macacus nemestrinus*), big, impudent beasts, which had been taught to pick coconuts. For this purpose, a band, to which a long rope was attached, was tied around the body of the ape, and then the animal was chased up into the tree. Arrived there, the ape seated himself on a branch and began to twist with his hands and feet one of the coconuts that hung under the branch, until the stem broke and the fruit fell down. If he dallied too long

¹Weber-Van Bosse, Mrs. A. *Ein Jahr an Bord I. M. S. Siboga, 1899-1900*. Leipzig, 2nd edition, 1905, p. 229.

over his work, the strap around his body was jerked unsympathetically. How the ape knew which nuts he was to pick remained a puzzle to me, but a fruit never dropped that was not fully ripened."

In 1904, Odoardo Beccari, the Italian explorer of Borneo, published the story of his journeyings in that great island during the years 1865–68.² Of *Macacus nemestrinus* he writes that it is trained by the natives and taught to gather coconuts.

Miss Isabella Bird, the well-known woman traveler, writes as follows:³

"A follower had brought a 'baboon,' an ape or monkey trained to gather coconuts, a hideous beast on very long legs when on all fours, but capable of walking erect. They called him a 'dog-faced baboon,' but I think they were wrong. He has a short, curved tail, sable-colored fur darkening down his back, and a most repulsive, treacherous, and ferocious countenance. He is fierce, but likes or at all events obeys his owner, who held him with a rope fifty feet long. At present he is only half tame, and would go back to the jungle if he were liberated. He was sent up a coconut tree which was heavily loaded with nuts in various stages of ripeness and unripeness, going up in surly fashion, looking round at intervals and shaking his chain angrily. When he got to the top he shook the fronds and stalks, but no nuts fell, and he chose a ripe one, and twisted it round and round till its tenacious fibers gave way, and then threw it down and began to descend, thinking he had done enough, but on being spoken to he went to work again with great vigor, picked out all the

²Beccari, Odoardo. *Wanderings in the Great Forests of Borneo: Travels and Researches of a Naturalist in Sarawak [1865-68]*. London, 1904, p. 30.

³Bird, Isabella. *The Golden Chersonese and the Way Thither*, New York, 1888, p. 425.

ripe nuts on the tree, twisted them all off, and then came down in a thoroughly bad, sulky temper. He was walking erect, and it seemed discourteous not to go and thank him for all his hard toil."

About eighty years ago Robert Fortune began his career as a botanical collector in China. From 1843-48 he collected for the Horticultural Society of London, while from 1848-56 he was a collector in the service of the Honorable East India Company. During the latter engagement, his collections of tea plants and tea-making tools played a large part in establishing the tea industry in northern India. The testimony of such a man regarding the general subject under consideration cannot be disregarded. In books published in 1852 and in 1853 he writes thus:¹

"I have even heard it asserted (I forgot whether by the Chinese or by others) that monkeys are employed for the same purpose [i.e. gathering tea leaves] and in the following manner:—These animals, it seems, do not like to work, and would not gather the leaves willingly; but when they are seen up amongst the rocks where the tea bushes are growing, the Chinese throw stones at them; the monkeys get very angry, and commence breaking off the branches of the tea-shrubs, which they throw down at their assailants! . . . I should not like to assert that no tea is gathered in these hills [of Woo-e-shan in the neighborhood of Tsong-gan-hien] by the agency of monkeys, . . . but I think it may be safely affirmed that the quantity procured in such ways is exceedingly small."

For our next reference we must go back nearly one hundred years, in fact

¹Fortune, Robert. *A Journey to the Tea Districts of China, etc.* London, 1852, p. 237, and *Two Visits to the Tea Countries of China, etc.* 2 vols. London, 1853, Vol. II, pp. 199-200.

to 1757, when Pehr Osbeck's *Voyage to China*² was published.

Among the curious and interesting things that he notes was the keeping of monkeys as pets by the Javanese, and in this connection he introduces the following statement apparently as an afterthought: "It is said that the monkies in China gather rhubarb and pound rice."

Edward Tyson closes his *Philosophical Essay concerning the Pygmies of the Ancients*,² published in 1694, with a reference to the activities of certain trained monkeys as recounted by three authors antedating him. Instead of giving this citation, the authors concerned will be quoted directly. It is perhaps needless to caution the reader that they wrote at a time when nature-faking was not condemned as it is today.

In 1670, Olfert Dapper⁴ published his book on Africa, and in his description of "Sierra-Liona" is found the statement appended below. There is no evidence that Dapper ever visited Sierra Leone, nor is there any to show from whom he got his information though he may have known of the citation immediately following this one. His words are:

"Three kinds of monkeys are found here; and there is one, of a certain species they call Baris, which they catch when little; raise, and train so well, that these monkeys can give almost as much service as slaves. Ordinarily they walk quite erect like men. They can grind millet in the mortar, and go to draw water in a pitcher. When they fall down, they

²Osbeck, Pehr. *Ostindisk Resa til Surat, China, etc.* [1750-52]. Stockholm, 1757. English translation by John Reinhold Forster, *A Voyage to China and the East Indies*. London, 1771, Vol. I, p. 152.

³Tyson, Edward. *Philosophical Essay concerning the Pygmies of the Ancients*. London, 1694, pp. 101-02.

⁴Dapper, Olfert. *Umbetändliche und eigentliche Beschreibung von Africa, etc.* Amsterdam, 1670. A French version is entitled *Description de l'Afrique, etc.* Amsterdam, 1686, p. 249.



In Egypt monkeys apparently at times shared with men the tasks of harvesting. In the picture—the original of which appears as a painting on the tomb of Hui—one man and four monkeys are engaged in the common labor of picking the fruit of the dôm palm. From Vol. IV, p. 341, of *A History of Egypt, Chaldea, Syria, Babylonia and Assyria*, by G. Maspero

show their pain by cries. They know how to turn the spit, and to do a thousand clever little tricks which greatly amuse their masters."

Going back still farther, in Petri Gassendi's life of the French scholar, Peiresc, published in 1641, is found the following interesting statement which agrees with the foregoing, in so far as the author's very unclassical Latin can be made out.

Peiresc was informed by a certain physician named Natalis, that in Guinea a particular kind of monkey

called Baris was of so gentle a disposition that it could be readily trained, taught to wear clothes, play on a pipe, husk grain in a mortar, assist in keeping the house swept and in order and in performing various other menial services.¹

Nearly seventy years earlier than Gassendi, José de Acosta, a Jesuit monk, one of the early explorers of the natural history realm of the new world, published in the natural history section

¹Gassendi, Petri. *Viri illustri Nicolai Claudi Fabrichii de Peiresc Vita.* Parisii, 1641.

of his work¹ the following account. It will be noted that he claims to have been an eyewitness of the incident mentioned. Perhaps, however, it is just as well that he did not print the account in that part of the work dealing with morals, for there greater sobriety of statement would seem to be required. He writes thus:

"I sawe one [monkey] in *Carthagene* [Cartagena] in the Gouvernour's house, so taught, as the things he did seemed incredible: they sent him to the Taverne for wine, putting the pot in one hand, and the money in the other; and they could not possibly gette the money out of his hand, before he had his pot full of wine. If any children mette him in the streeete, and threw any stones at him, he would set his pot downe on the one side and cast stones against the children till he had assured his way, then would he returne to carry home his pot. And which is more, although hee were a good bibber of wine (as I have oftentimes seene him drinke, when his maister has given it him) yet would he never touch it vntill leave was given him."

For our next citation we must delve into the past about 1400 years to Philostratus called "the Athenian" to distinguish him from others of the name. Philostratus, who was born *circa* 170 A.D. and died in 245, was a disciple of the Greek Pythagorean philosopher, Apollonius of Tyana, who was born a few years before the Christian era. Apollonius traveled extensively and among the countries he visited was India. He died at the age of about one hundred years at Ephesus where he had established a school.

The narratives of the travels of

¹Aresta, José de. *Historia natural y moral de las Indias, etc.* Sevilla, 1590. English version by Edward Grimston, *Natural and moral historie of the East and West Indies*. London, 1604, p. 315. (Reprinted 1880 by the Hakluyt Society, as its Volume LXI.)

Apollonius were collected and written out in full by Philostratus. In the English version² of these we read that near the river Hyphasis, which traverses India, the parts of the mountains which stretch down to the Red Sea are overgrown with aromatic shrubs, as well as many other species of plants, including pepper trees, which he states "are cultivated by the apes."

"It [the pepper tree] grows in steep ravines where it cannot be got at by men, and where a community of apes is said to live in the recesses of the mountain, and in any of its glens; and these apes are held in great esteem by the Indians, because they harvest the pepper for them. . . For this is the way they [the apes] go to work in collecting the pepper; the Indians go up to the lower trees and pluck off the fruit, and they make little round shallow pits around the trees, into which they collect the pepper, carelessly tossing it in, as if it had no value and was of no serious use to mankind. The monkeys mark their actions from above out of their fastnesses, and when the night comes on they imitate the actions of the Indians, and twisting off the twigs of the trees, they bring and throw them into the pits in question; then the Indians at daybreak carry away the heaps of spice which they have thus got without any trouble, and indeed during the repose of slumber."

Our next excursions in ancient history take us to the valley of the Nile and here we find in paintings on the tombs three illustrations of monkeys serving man. To one of these I am unable to assign any date whatever, but for the other two fairly definite times can be set.

²Philostratus ["the Athenian"]. *The Life of Apollonius of Tyana*. English translation by F. C. Conybeare. 2 vols. London and New York. (Reprinted, 1917.) Vol. I, p. 239.

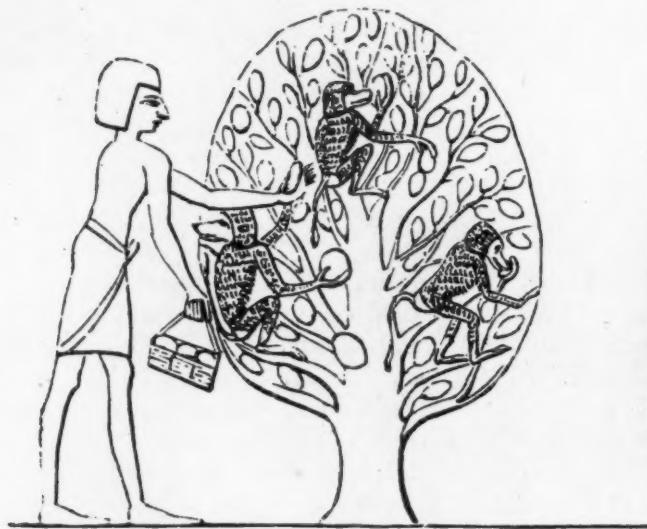
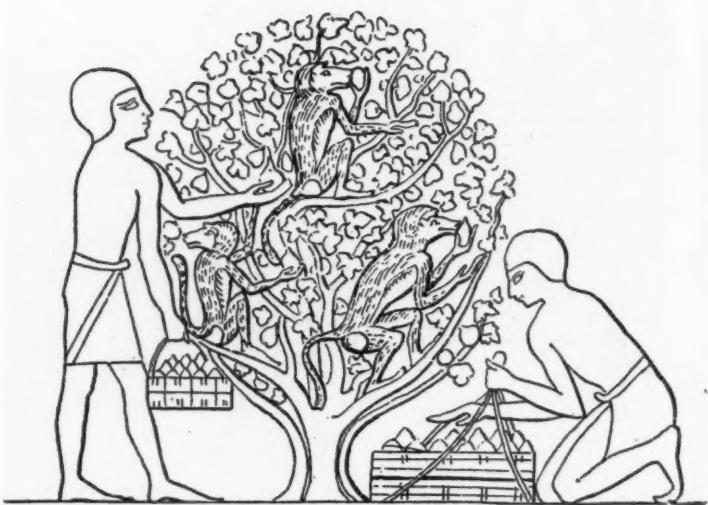
FRUIT GATHERING IN EGYPT

The upper picture, reproduced from a tomb at Beni Hassan belonging to the Twelfth Dynasty of the Old Kingdom, bears witness to the fact that monkeys were used by the Egyptians as fig-gatherers. Judging from the propinquity of fruit and mouth in the case of two of the apes, it is permissible to infer that in addition to assisting their masters, these animals occasionally helped themselves.

The lower picture is similar in character to the upper one but differs somewhat in details. It, too, is taken from a tomb at Beni Hassen and dates from the same dynasty. Both of these records are,

therefore, several thousands of years old,—by the lowest estimate about forty-four centuries; yet the practice therein depicted persists in certain parts of the world even today.

The upper picture is a reproduction from the cut on p. 199 of *Life in Ancient Egypt*, described by Adolph Erman, and translated by H. M. Tirard; the lower picture is from Vol. I., page 382, of *The Manners and Customs of the Ancient Egyptians* by Sir Gardner Wilkinson, revised and corrected by Samuel Birch.



In Maspero's *History of Egypt*,¹ there is a reproduction of a picture from the tomb of Hui which this distinguished Egyptologist says "represents men and monkeys gathering the fruit of a group of dôm palms."

Another representation of this use of the monkey is found in the accompanying figure from Adolf Erman's *Aegypten*.² With reference to this figure Erman notes that fig trees have gnarled trunks, that they rarely attain more than sixteen feet in height, and that they have limbs too weak to sustain the weight of the gardeners. Hence people "send tame monkeys into the branches to gather the fruit for them."

This figure is credited to Lepsius' great work,³ from which we learn that it is reproduced from a tomb at Beni Hassan belonging to the Twelfth Dynasty of the Old Kingdom. According to accepted Egyptian chronology the Twelfth Dynasty dates from 2800-2500 B.C. or according to Petrie (1906) its time was 3450 years before the Christian era. And in this remote antiquity monkeys had been trained to perform menial services for man.

Yet another figure and reference remain. Sir Gardner Wilkinson in his great work on the ancient Egyptians,⁴ has this to say on the subject. "Monkeys appear to have been trained to assist in gathering the fruit, and the Egyptians represent them in the sculptures handing down figs from the sycamore-trees to the gardeners below; but, as might be expected, these animals amply repaid themselves

for the trouble imposed upon them, and the artist has not failed to show how much more they consulted their own wishes than those of their employers.

"Many animals were tamed in Egypt for various purposes . . . and in the Jimma country, which lies to the south of Abyssinia, monkeys are still taught several useful accomplishments. Among them is that of officiating as torch-bearers at a supper party; and seated in a row, on a raised bench, they hold the lights until the departure of the guests, and patiently await their own repast as a reward for their services. Sometimes a refractory subject fails in his accustomed duty, and the harmony of the party is for a moment disturbed, particularly if an unruly monkey throws his lighted torch into the midst of the unsuspecting guests; but the stick and privation of food is the punishment of the offender; and it is by these persuasive arguments alone that they are prevailed upon to perform their duty in so delicate an office."

From Wilkinson is reproduced the accompanying picture showing monkeys gathering fruit. This figure, also from the tombs of Beni Hassan, is very similar to that reproduced from Erman but is different in details. It likewise dates from the Twelfth Dynasty.

Here then we have accounts and illustrations showing monkeys gathering coconuts in Java in the present year of grace, and at the other end of the time scale we have Egyptian rock paintings and carvings showing how monkeys assisted in gathering figs and dôm palm fruits not later than 2500 B.C. and possibly as early as 3450 years before the birth of Christ—at the lowest figure a range of more than 4400 years, at the largest a range of 5370 years.

Verily there is nothing new under the sun.

¹Maspero, G. *A History of Egypt, Chaldea, Syria, Babylonia and Assyria*. Edited by A. H. Sayce. Translated by M. L. McClure. London, n. d. Grolier Society edition, Vol. IV, p. 341.

²Erman, Adolf. *Aegypten und aegyptisches Leben im Altertum*. Tübingen, 1885, p. 279. English version by H. M. Tirard, *Life in Ancient Egypt*. London, 1894, p. 199.

³Lepsius, R. *Denkmäler aus Aegypten und Aethiopien*, Vol. IV, Section 2, p. 127.

⁴Wilkinson, Sir Gardner. *Manners and Customs of the Ancient Egyptians*. 3 vols. New edition, revised and corrected by Samuel Birch. New York, 1879, Vol. I, pp. 381-82.

The Buffalo Drive and an Old-World Hunting Practice

A CULTURAL PARALLEL BETWEEN THE LAPPS AND THE NORTH AMERICAN INDIANS

BY ROBERT H. LOWIE

Associate Professor of Anthropology, University of California

ONE of the perennial questions debated by anthropologists relates to the independence of aboriginal American culture. The point at issue is really not so much the existence as the extent of alien features in the customs, beliefs, and arts of the natives. Probably everyone admits that the sinew-backed bow of the Far West must be conceived as an Asiatic intrusion; but American ethnologists have not been convinced that the essential features and higher developments of the New World cultures imply importation from the Eastern Hemisphere.

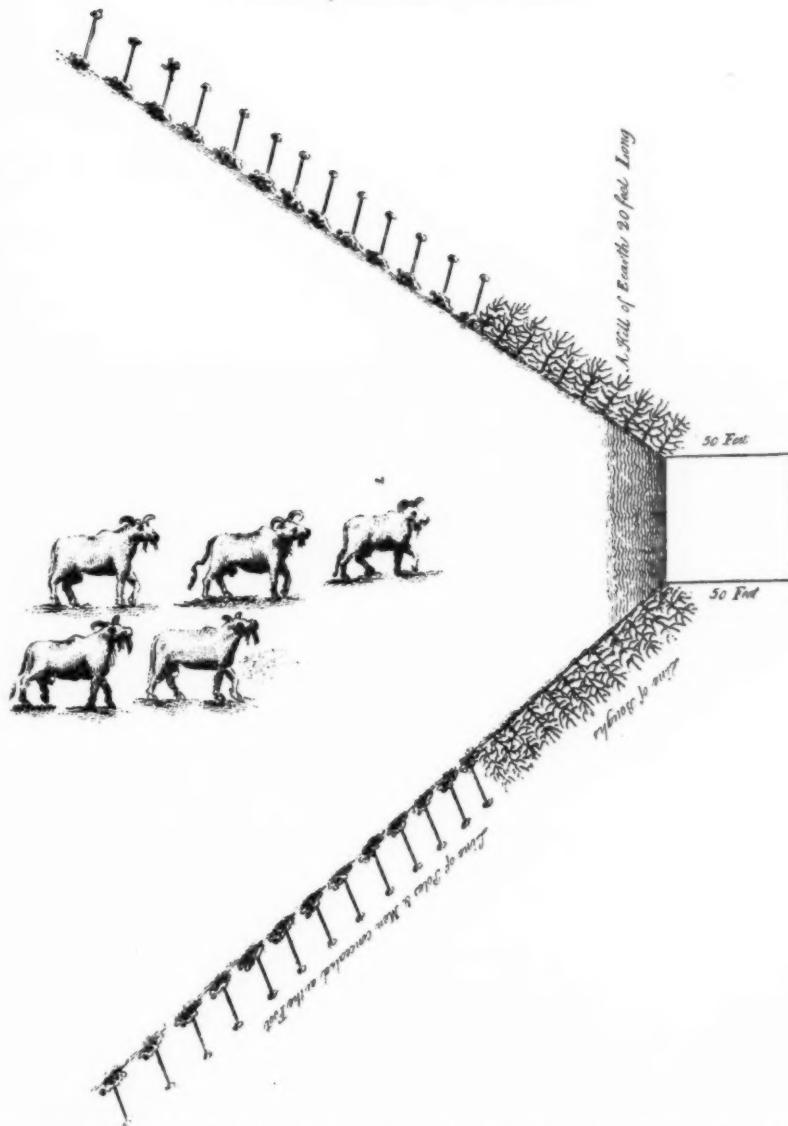
In the following paragraphs I wish to call attention to an old Lapp custom that strikingly resembles a North American practice. The similarity has been noted by Hatt, but without direct reference to its historical significance; according to this writer the usage also extends to the Samoyed of western Siberia.¹ My subject is the impounding of game in a communal hunt. The source of information for the Lapps is an old narrative by Tornæus, whose report, dating back to 1672, is partly reproduced by the noted Finnish linguist and ethnographer, Castrén.² The English rendering is my own.

¹"Notes on Reindeer Nomadism" by Gudmund Hatt (*Memoirs*, American Anthropological Association, Vol. VI, p. 94).

²*Reiseerinnerungen aus den Jahren 1858-1844* by M. Alexander Castrén. Published by A. Schieffner, St. Petersburg, 1853. Page 44 f.

The *wuomen* is made as follows. For a distance of one or two miles lengthwise, the width being one or more miles, the hunter sets up high posts on level or bald, woodless rocks, *quasi duo cornua* (like two horns). First he sets the posts at some distance from one another, but as he proceeds (for the length of the distance is one or two miles) he sets them closer together and puts on each pole some black and horrible object, from which the reindeer recoil. When he gets to the *angustiora* (narrower parts), he constructs field hedges after the fashion of those customary in Sweden, and high fences over which the reindeer cannot jump. As soon as he arrives in *angustissimo* (in the narrowest section), he makes a five-stepped slope, at the foot of which there is a lofty and strong enclosure, well protected like a stockade or blind alley, so that no creature could escape from it. Then the Lapp travels about in all the mountains; wherever he finds reindeer herds, he drives them carefully and gradually in the direction of his *wuomen*. When the reindeer get between the posts, they dare not pass through either side because they are afraid of the black objects on the posts. The Lapp and his followers are in the rear and take care lest the reindeer turn back, letting them step slowly forward and occasionally eat white moss (their diet), lie down and rest as though no danger at all were impending. But when they get *ad angustiora* and *angustissima* (to the narrower and narrowest parts), where there is a strong fence on both sides, he proceeds after them with might and main, driving the reindeer *in præcipitum* (headlong) down the

Plan of a Buffalo Pound.



This illustration, derived from a quaint volume published in 1790 and entitled *The Present State of Hudson's Bay*, is of particular interest because in it are shown not only the two converging rows of crouching Indians but, towering above them, poles that in some respects recall those used by the Lapps in impounding reindeer. Edward Umfreville, the author of the volume, states that—after the erection of the walls of the pound, which in some cases is circular, in others square, and the construction in front of it of the hill of earth and the converging lines of boughs, shown in the picture—"a number of poles, nearly fifteen feet long each, are placed at about twelve feet distance from each other, with a piece of Buffalo dung on the top, and in a straight line from the boughs above mentioned. At the foot of each pole a man lies concealed in a Buffalo skin, to keep the animals in a straight direction to the pound. These poles are placed alike on each side, always increasing in breadth from one side to the other, and decreasing in the same proportion as the animals approach the pound."

The sedate movements of the bison in this illustration are in striking contrast to the frenzied confusion of the animals in the picture of the communal hunt of the Cree

five steps he has made. From there they are not able to jump up again but are compelled to remain *in suo carcere* (in their prison). Then the Lapp comes whenever he so chooses and kills them all, large and small, thus destroying the breeding of reindeer in the country, for which reason such men are hated by the other Lapps.

To every reader of North American ethnographic literature this account must at once recall the method employed by some Plains Indian peoples in impounding buffalo and by tribes farther north in impounding caribou. Hind's picture of a Cree buffalo stampede has been rendered accessible by Dr. Clark Wissler.¹ There we see the lines converging, the circular enclosure toward which they lead, the hunters driving the game through the passage created by them. Only two significant differences appear: the absence of a slope before the pound

¹The American Indian by Clark Wissler, opposite p. 11.

and the substitution of men for posts in the formation of the two lines. Other North American reports, however, make it clear that elsewhere, in part at least, some of the converging walls were made of sticks and that an inclined plane was used in one of the most characteristic forms of this method of hunting.

Altogether, I cannot escape the impression that we are here face to face with a cultural parallel which implies a single center of origin, that the impounding of game in the manner described evolved possibly in some Siberian tribe and thence spread to the east and the west. It is indeed a far cry from the Samoyed to the nearest North American aborigines, but the resemblance is too great and the feature too complex to permit the assumption of independent invention. Perhaps further inquiry will serve to discover traces of the custom in western Siberia.



This picture, reproduced from Hind's *Narrative of the Canadian Red River [Exploring] Expedition of 1857*, shows a communal hunt of the Cree. Two converging lines of Indians, some gesticulating, others aiming arrows, tend to prevent the escape¹ of the affrighted animals either to the right or to the left, while other Indians armed with weapons are driving them to their doom in the circular pound seen in the distance



Bushmen hunting with bows and arrows

The Natives of South Africa¹

By ROBERT BROOME

Corresponding Member of the American Museum

POPULARLY and even semi-scientifically it is the belief that the natives of South Africa present to us a very simple and easily solvable problem. The races are generally held to be (1) the famous Bushmen—light-skinned, stunted, untameable savages, almost verging on the semi-human, who are believed to be the aborigines; (2) the Bantu or Kafir tribes—a dark-skinned, powerfully-built race, somewhat resembling the Negro and who within comparatively recent times have come down from the north; and (3) the Hottentots—a second light-skinned race who resemble the Bushmen in some characters and, it is thought, are a cross between the Bushmen and the Bantus.

Recent discoveries of skulls of very great antiquity, belonging to races which are not Bushmen, and the published statement by the director of the

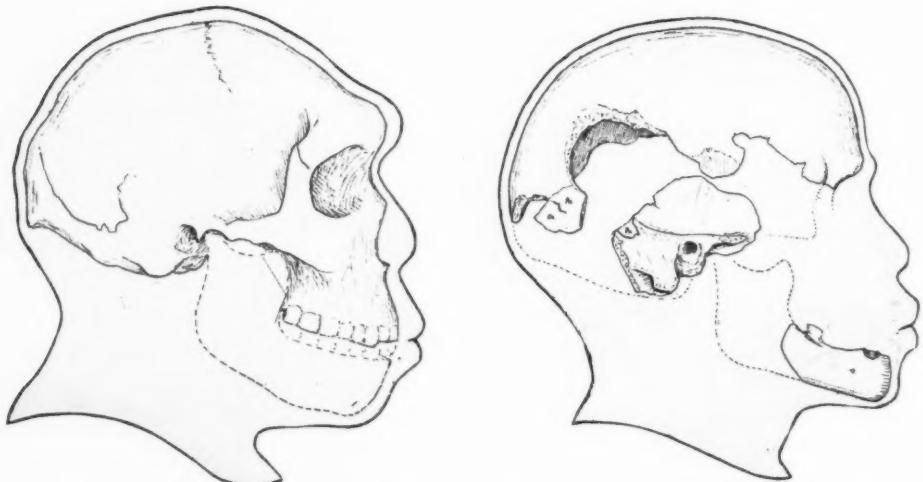
South African Museum that he is unable to tell a recent Bushman from a recent Hottentot have thrown much of our supposed knowledge into confusion.

About ten years ago there was discovered at Boskop in the Transvaal a completely fossilized human skull. Unfortunately the skull is imperfect, practically all the face and much of the jaw being lost; and we are quite unable to give even its approximate age. Still we can quite confidently state that it must be very ancient. The skull is of enormous size—in fact, one of the largest human skulls on record. Most Europeans have a brain capacity of from 1400 to 1600 c.c., and only in very exceptional cases do we find a brain capacity of 1800 c.c. Bismarck, Sir Walter Scott, and a few such geniuses had enormous brains, but the Boskop man had a brain possibly larger than that of any of them. I estimate that

¹The photographs accompanying this article were taken by Mr. A. M. Cronin and are here reproduced by courtesy of Miss M. Wilman, curator of the McGregor Museum, Kimberly, into the possession of which they have passed

his brain capacity was at least 1950 c.c. The skull is also extremely thick—in parts nearly three times as thick as that of the average European. Concerning the affinities of this Boskop man we know but little. Notwithstanding the enormous size of the skull, its breadth and height indices and general shape agree so closely with those of the degenerate Bushmen as to suggest that the stunted Bushmen of today are probably the direct descendants of

differs considerably, and the shape of the face differs very greatly. When this Broken Hill man lived we cannot at present say but like the Boskop man his antiquity must be very great. This primitive human type has been named *Homo Rhodesiensis* by Smith Woodward, and Elliot Smith from the examination of the brain cast considers him more primitive than any other known type of extinct man except the ape-man of Java and the Piltdown



Outline drawing of the Broken Hill skull, after a photograph by Smith Woodward (reversed), with outline of the soft parts restored

the large-brained race represented by the Boskop man.

About two years ago a far more remarkable ancient human skull was found at Broken Hill in Rhodesia. Fortunately this skull is nearly perfect, only the lower jaw being missing. The top of the head is comparatively flat as in the ape-man, *Pithecanthropus erectus*, of Java, and over the eyes there are enormous gorilla-like bony ridges. In appearance the skull bears some resemblance to the Neanderthal skulls of Europe, but the shape of the brain case

Restoration of the Boskop skull, with outline of the soft parts,—the representative of the great-brained prehistoric race of South Africa

man of Sussex. Though there is no race at present surviving, the members of which might be regarded as the little-modified descendants of *Homo Rhodesiensis*, we nevertheless find clear evidences of an Australoid strain in some still-surviving races, and it is not improbable that this is due to an admixture in other races of the blood of the descendants of the race represented by the Broken Hill man. Occasionally we meet with a Korana with supra-orbital ridges not much inferior in size to those of *Homo Rhodesiensis*,

and I have seen a Korana with a sloping brow almost as flat.

Of surviving races the Bushmen are among the most interesting. The Bushmen, as seen today in the Kalahari and Southwest Africa, are a somewhat dwarfish race with small faces, hands, and feet and usually with short curly hair on the head and comparatively little hair on other parts of the body. Occasionally, however, there is fairly long hair on the scalp, and this suggests that the very short hair often seen is a secondary character. Though the Bushmen are usually regarded as dwarfs, it is well known that many of the early Cape Colony Bushmen, who could obtain good supplies of game, were men and women of quite ordinary size, and even today if the very young children of dwarfish parents are taken to farms and well fed, they grow to a fair stature.

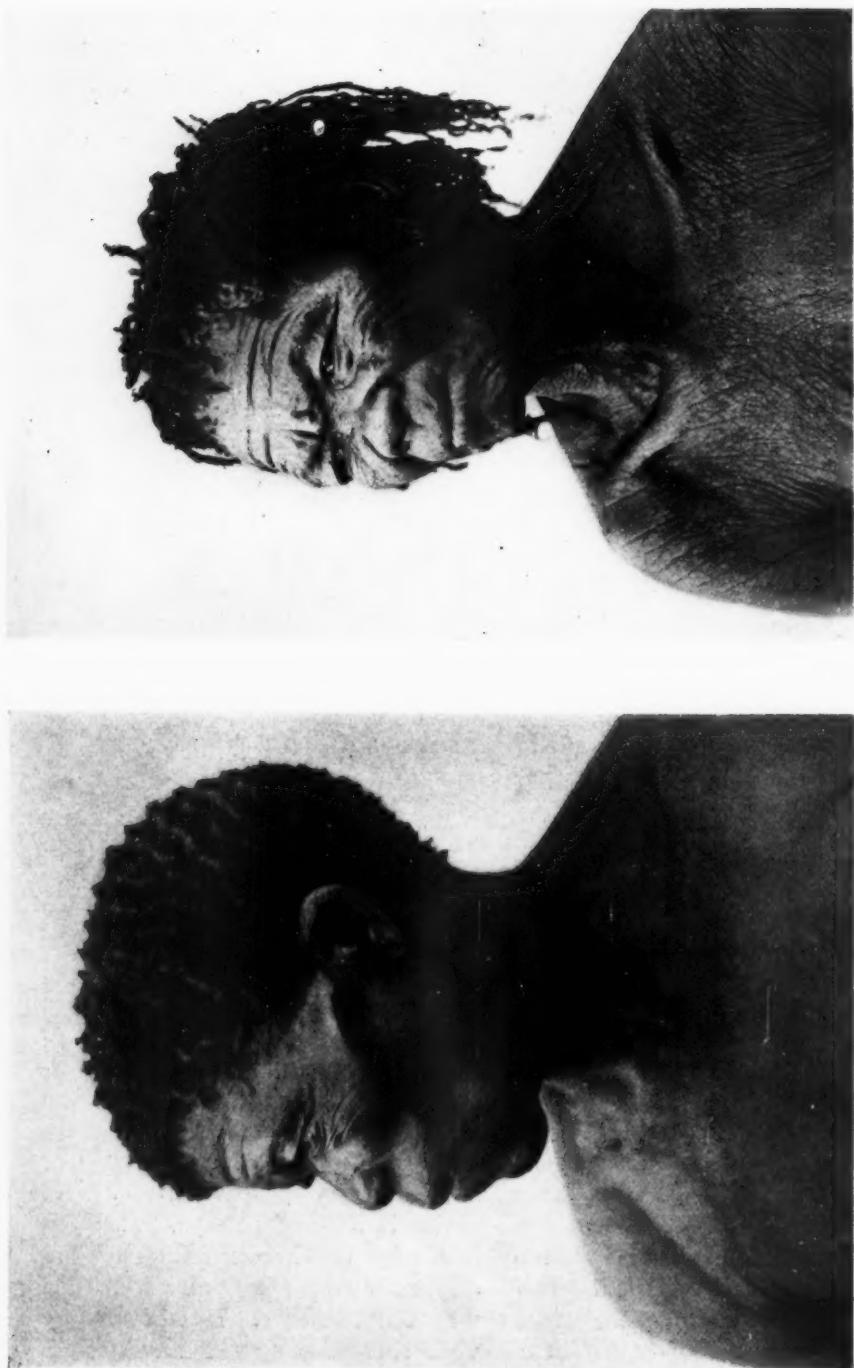
In Cape Colony pure Bushmen are now rather rare, though they must still number many hundreds. In early days they were looked upon by the white farmers who had invaded their hunting grounds as untameable, semi-human savages, and were shot at sight. As the Bushman might be lurking anywhere, with the cunning of an American Indian, ready to discharge his poisoned arrows, and as he gave and asked no quarter, and furthermore refused to make any distinction between the sheep and cattle of the farmer and the wild buck of the veld, it is not to be wondered at that hunts were organized and the Bushmen nearly exterminated. There was no League of Nations in those days to whom the weak could appeal and so, like the Tasmanians, the Australians of Victoria and New South Wales, and many American Indian tribes, the Bushmen were killed off or driven away.

Fortunately there are still a fairly large number left in the Kalahari and Southwest Africa, where their language, folklore, and habits can be studied.

The Hottentots were a more civilized race, who kept cattle and sheep, worked in metals, and were ready to trade with the whites. In appearance they resemble a little the Bushmen, having somewhat similar flat noses, but they are usually hairier. The shape of the head differs entirely, being long and narrow, and by this alone a pure Hottentot can always be distinguished from a pure Bushman. In fact, the Hottentot is one of the narrowest-headed human races known. The ratio of the breadth of the skull to the length in the Hottentot is almost invariably under 70 to 100 and is frequently as low as 64. In the pure Bushman the cephalic index is usually between 76 and 80.

There is one tribe which is usually grouped with the Hottentots, but which differs appreciably. I refer to the Koranas. This is the race which the early travelers found inhabiting the Orange and Vaal river valleys near the middle of South Africa. The members of this race differ from the Hottentots of the west in being of a darker complexion, in having broader noses and frequently in having well-developed supra-orbital ridges. They are a stupid, indolent race and the examples given by Campbell of their mentality are very characteristic. "No nation in Africa," he says, "has been found by the Missionaries more indifferent to all kinds of information than the Corannas. If a Missionary visits a Kraal they will attend to his address; if he chooses he may remain; if he goes away they manifest no wish to detain him. They are equally in-

A PRACTICALLY PURE BUSHMAN AND BUSHWOMAN OF THE KALAHARI
The Bushmen of this area of South Africa are somewhat undersized in appearance, with small faces, hands, and feet. Although the head is usually covered with short, curly hair, individuals having fairly long hair are occasionally seen. In his letter transmitting these two portraits the author speaks of them as "the finest Bush studies ever published!"



A BUSHGIRL AND TWO BUSHMEN
The girl and the man on the right are from the Kalahari



different to his coming, remaining, or departing; they feel indisposed to any effort of mind or body. Mr. Sass, who knew the Corannas well, from a residence amongst them, gave me a striking illustration of the contracted state of their mental powers. 'Suppose,' said he, 'that you ask a Coranna man how



This young Korana resides at Douglas, South Africa. The Korana are frequently grouped with the Hottentots but they differ from them in certain of their features as well as in their darker complexion

many children he has. He muses for a while, looking toward the ground; then raising his head he appears to be engaged in calculating with his fingers. Yet after all this he requests others to assist him in solving the difficulty. After further calculation again upon his fingers, he will look you in the face, and tell you he has three!"'

Physically the Korana seems to be a Hottentot with a quite appreciable Bantu or Negro strain, and also some blood of the Australoid race, but whether these admixtures were acquired

in the north or in South Africa is at present unknown.

The Bantus or Kafir tribes are by far the most numerous peoples of South Africa. Under the term Bantu are included a large number of different tribes of Negro-like natives who are scattered over the greater part of Africa south of the equator. Physically the Bantus include some of the most handsomely built specimens of mankind, and some of the women are as graceful as the Venus of Melos, and while intellectually the average is below that of the European, the race has produced some leaders of the very greatest ability.

The Bantu tribes differ often very greatly from each other in appearance. This is due evidently to the admixture with different races. Some of the southern tribes give clear evidences of a Bushman strain; others of a Hottentot infusion. Many of the northern tribes seem to have Semitic blood in their veins.

In north Damaraland there is a Bantu tribe which has lost its own language and now speaks the Hottentot language. These are the Berg Damara, of one of whom I am able to show a photograph. It has been held that the Hottentots were always a feeble folk, never numbering more than a few thousands. But this seems very unlikely when we consider that the Hottentot language is spoken by this Bantu tribe in the north of Southeast Africa, that Hottentots speak or spoke it along the west and south coasts of Cape Colony, and that the Koranas of the Orange and Vaal river valleys also spoke a dialect of it. The very wide extent of this remarkably distinct language would also make us hesitate in accepting the view of certain scientists that the Hottentot is only a Bush

and Bantu cross. Certainly the language is not a Bush and Bantu cross, nor does the skull appear to be, being narrower than even the Bantu.

The future of the various races of South African natives can be foretold with much probability. The Bushmen and Koranas are rapidly passing away as distinct races, the remaining individuals being steadily absorbed by the other races, mainly by the mixed Hottentots, and in one hundred years it will be difficult to find a pure Bushman or Korana. The Hottentots will survive longer as a distinct race. In Namaqualand, where there will never be any very extensive white settlement, they may survive in a state of relative purity for some hundreds of years, and so also in Southwest Africa, but in other parts of South Africa they are bound to become absorbed into the mixed Cape Race or the Bantus.

But the future of the Bantus is very different and provides those of us who dwell in South Africa with our most alarming political problem. Almost all colored races of man go down before the onslaught of the white man's diseases and alcoholic drinks. The South Sea Islander, the Australian, the Bushman are all passing away; but the Bantus thrive, and today are multiplying twice as fast as the whites. Every Kafir wishes to have a family and generally marries young. Polygamy has been recognized from time immemorial and even Christian missions have to compound with it. Since devastating native wars have ceased under the *Pax Britannica*, the sexes have become more equalized, and polygamy is now the exception, but it is still largely practised in the native territories. Every woman becomes the mother of children and many have large families. At present the Kafirs or

Bantus outnumber the whites by about five to one, and every year the proportion of black to white is becoming larger. Before very many years it must be ten to one, and before the present century draws to a close it seems very certain that the Kafir will rule the whole of South Africa, and white civilization be replaced by black.

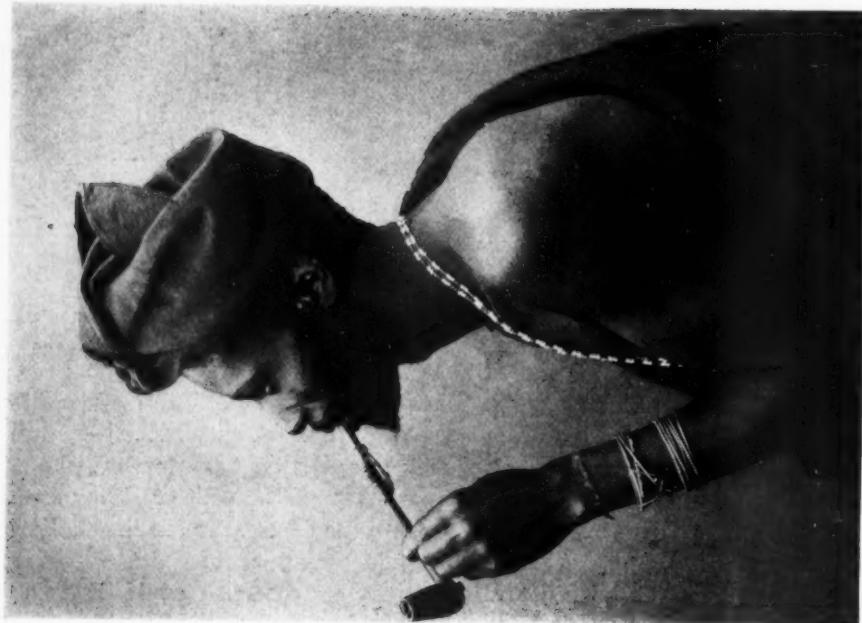
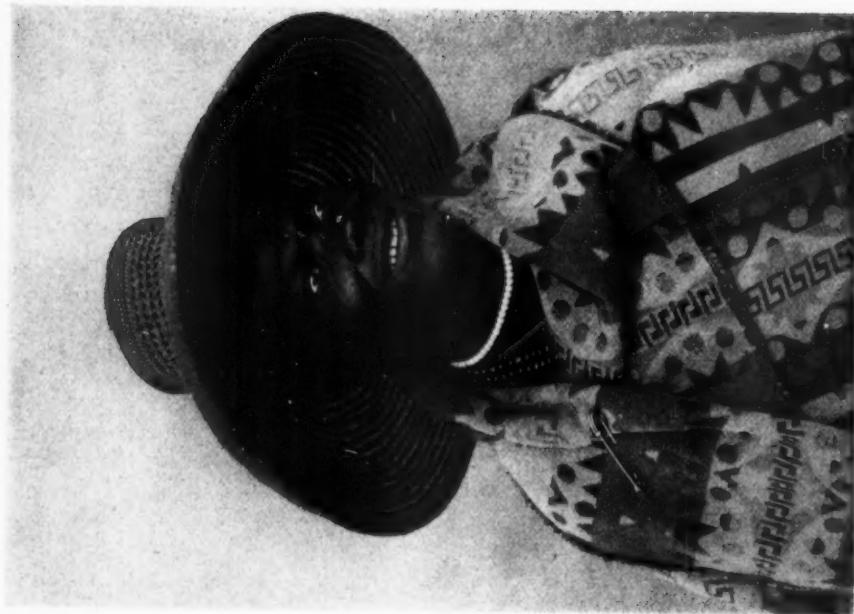


The Berg Damara, of which this individual is a representative, is one of the Bantu tribes that speaks the Hottentot language

There will be no need for the Kafirs to rise in rebellion in order to gain commanding power; they have only to breed and to study. The Kafir chiefs are often men of great intellect, and they are certainly better statesmen than many of the whites. They look far into the future. In the first half of the nineteenth century there was a continuous succession of Kafir wars, and the blacks showed that they must be classed as formidable warriors. But since the Zulu war of 1879 there has been no serious native war. There has, however, been far more serious

XOSA MAN (LEFT) FROM EAST CAPE COLONY AND MASUTO WOMAN (RIGHT) FROM BASUTOLAND

290





ZULU TYPES



BANTU TYPES

On the left is a Matabele from Rhodesia; in the center is a Mutchopi from Delagoa Bay; on the right is a Swazi





BANTUS FROM BECHUANALAND
On the left is a Motlharo; in the center is a Morolong; on the right is a Mokgathla

native peace. When there was a little rising in Zululand about a dozen years ago and hundreds of Zulus were shot down by machine guns, the Zulu mothers quietly said, "We can breed sons quicker than you can shoot them down."

In olden times the Hottentots were the more or less docile slaves of the Dutch and French immigrants. They were intellectually and physically too inferior to the whites ever to be any source of direct danger. But unfortunately the very inferiority of the Hottentots has given rise to the idea in the minds of many of the white colonists that all colored races are inferior, and that there is really no danger from the Kafirs, and as a result the Kafirs have been encouraged to come into Cape Colony, most of which was really originally the country of the Hottentots and the Bushmen.

Already the Kafir has displaced the Hottentot as the laborer in most of the towns, on the railways, and on most of the farms of the middle of Cape Colony. He is also displacing the poorer class of whites and the less intellectual. In most countries the unskilled labor is performed by this class of whites, but here in South Africa the Kafirs can do it more cheaply than the whites, and can do it just as satisfactorily. Hence there is nothing for the poor white man to do. Already we have in South Africa tens of thousands of a class that has no counterpart in any other country in the world—the "poor whites"—not well enough equipped through intellect and education for the performance of

skilled labor and with no unskilled labor for them to do. Every year sees the problem getting worse. The government tries to help by creating labor colonies, land settlements, and through other schemes, but for every thousand relieved, two thousand more seem to arise.

This class of "poor whites" with no steady work to do, and too often on the border of starvation, is a constant source of danger, being a ready tool in the hands of unscrupulous politicians. In 1914 there was quite a serious rebellion and this year again there was an attempted revolution in the Transvaal. Both these uprisings have been put down by the government, but the disease continues. Until recently the Kafir competed only in unskilled labor; now he is entering the fields of skilled labor, and very steadily but surely displacing more and more whites.

Many years ago Balfour said that South Africa had a terrible problem in the native question, and he added, "I do not envy the man who has to tackle it." Whether for good or for ill to the world the Bantu and Negro tribes are going to play a big part in the future. It is well we should study them.

All the photographs illustrating this paper have been taken by Mr. A. M. Cronin, and are selected from what is probably the finest collection of studies of South African natives that has ever been made. The collection belongs to the McGregor Museum, Kimberley, and those here presented are published by the kind consent of the curator of that museum, Miss M. Wilman.



A group of white oak trees, *Quercus lobata*, at Diablo, Contra Costa County, California. On the ground under one of these the jumping "seed" was found

Jumping "Seeds"

PLANT GROWTHS THAT HOP ABOUT LIKE FLEAS

By FRANK A. LEACH

IN THE fall of 1920, my attention was called to some diminutive globular objects that were lying on the ground under a large white oak tree (*Quercus lobata*) and that appeared to be possessed with life. They were about the size of and looked like mustard seed. Upon gathering a few in the palm of my hand and examining them, I was led to the conclusion that they were indeed some kind of seed, notwithstanding the fact that the locality possessed no plants that produced seeds similar to them, either in size or character. Still more mystifying was the circumstance that upon the slightest disturbance they jumped or hopped about in a surprising manner. They had, of course, no legs or other appendages, yet they could jump to the height of half an inch and twice as far horizontally in a way very suggestive of the actions of that disagreeable little pest, the flea.

"What are they?"

This was the inquiry of all who saw them, but there was no answer, for no one present knew, or had ever seen them before. Their vegetal appearance and jumping proclivities, it was generally admitted, suggested that they must be somewhat akin to the Mexican jumping "beans," so for some time afterward they were generally referred to as "jumping seeds." Though conceding that appearances afforded some justification for it, I was not entirely satisfied with the conclusion. If these curious little things were seeds, where was the mother plant? If they were not seeds, what could they be? The problem must be solved, but to whom should we go for help,—the botanist or the entomologist?

We addressed individuals, far and near, but no one had ever heard of the seedlike objects. At the end of about a week or ten days, my specimens be-

came inactive. Therefore, very soon after I began my campaign of investigation, I could only describe their capacity for jumping, being unable to produce ocular evidence of the fact. From the incredulous stares I received, I was not sure whether people thought I was just mistaken in my observations, or was muddling up Mark Twain's well-known story of the "Jumping Frog of Calaveras."

Days and weeks passed and no headway was made in solving the mystery. Months before, when I first obtained the strange objects, I had opened several but the contents then appeared nothing more than shapeless plant tissue. I resolved, however, again to examine the interior of one. On opening a "seed" I was surprised to find within it a small winged insect. It proved to be one of the Cynipidae, belonging to the Hymenoptera, an order that includes the bees, ants, wasps and saw flies.

With the statement that the Cynipidae are among the "makers" of the oak tree galls, the significance of this identification will be more clearly understood. These insects to the uninitiated look more like little flies than wasps, hence they are sometimes referred to as "gall flies" but, correctly speaking, they are "gall wasps."

My son Ed, who had also been interested in the effort to identify the little stranger, said, "If the structure that housed the insect is an oak gall, the material composing it should contain tannic acid." Acting on the suggestion, the pieces were submitted to a chemical test, and a strong reaction was obtained, showing the presence of the well-known acid. As a result it seemed almost beyond question that the queer little globular things were minute oak galls, although,

of course, the chemical test was not conclusive.

It was now in the spring of the year when the oaks were just beginning to put forth their new leaves and therefore too early to find any galls. The winter storms and winds had destroyed or swept away all the leaves of the preceding year, so there was nothing to do but wait until the new leaves were developed and the gall wasps of the season had pierced the tissue of the foliage in the egg-laying act. It is this operation that causes the growth of the gall.

While considering these circumstances another question arose: how did the galls found on the ground in the previous fall become detached from the leaves of which they were apparently a part? A little thought afforded an answer. The fallen leaves were raked up daily and carted away; the galls were found in greatest number where piles of leaves had been. Apparently the operation of raking detached many of the galls from the leaves. In this connection it should be noted, however, that this gall is probably not dependent on artificial means for a separation from its leaf. Mr. Charles V. Riley states of either this or a closely related gall:¹ "It falls from a cavity on the under side of the leaves, very much as an acorn falls from its cup, and is sometimes so abundant that the ground beneath an infested tree is literally covered."

It occurred to me that there was another test to which I ought to subject the little jumpers before finally abandoning the theory that they were "seeds." Therefore a number were placed in moist earth and another lot between moistened blotters, and such

¹*Proceedings of United States National Museum*, Vol. V, p. 634.

careful attention was given them that had they been seeds, some of them at least would have exhibited evidence of the fact by sprouting. Not a sign of germination appeared. On the contrary, in about two weeks the little spheres were wholly enclosed in a covering of fuzzy mildew.

About the time I subjected some of the supposed "seeds" to a germinating test, I gave others to my son, to breed out the insects they presumably contained. In the last part of June, upon making an examination of the condition of these "seeds," we were pleased to find that one of them was ruptured and had given egress to a diminutive four-winged insect, in all respects exactly like the one I had found some weeks previously. Upon opening another "seed" and finding that it contained a pupa, we returned the remainder of the "seeds" to their cage, but no more insects made their appearance.

The jumping phenomenon¹ is not the only feature of interest in relation to the gall and its occupant. Some of the later things discovered regarding it were nearly as surprising. I found that the little wasp, when it had reached the stage of maturity and was ready to be released from the confines of the gall, completely filled the interior, much as a young chicken when about to hatch fills the egg. The walls of the gall are thinner than the shells of eggs, a condition that enables the wasp to escape by bursting them apart. This circumstance is remarkable, in view of the fact that so many of the inmates of the larger galls bore holes through their vegetal prisons and thus gain egress to the outer world. In a

number of such instances, the galls are many times the size of their respective insect occupants, whereas the wasp of the jumping gall looks larger than the gall whence it came.

In addition to the detached galls, specimens still fastened to the leaf were necessary to the investigation. Soon after the oak trees commenced to send forth their leaves, I began to examine them for the coming of the little curiosities, but it was well along in the month of May before I found any promise of success for my efforts; then I began to find here and there, as I had expected, on the underside of the new leaves, little spherical excrescences, that in the course of a few weeks assumed the exact shape and exterior peculiarities of the "jumpers."

Gratifying as this was, I had yet to find galls in the active or jumping stage to show that the diminutive growths on the leaves and the jumping "seeds" of the previous season were one and the same thing. When this should be accomplished, my discovery, if discovery it was, would be ready for announcement. However, encouraged though I was to believe that something new in nature's work was about to be given publicity, I could not altogether avoid the thought how strange it was that such an unusual occurrence in nature should have heretofore escaped all notice.

As it must be the life within the gall that supplies the force for its peculiar activities, I reasoned that the larva upon emerging from the egg would have to grow and gain the necessary strength before it could make its habitation hop about in response to its sudden movements. Of course I did not know at what time that stage would be reached. I could only watch and wait for it. It was in the

¹In *The American Naturalist*, Vol. X, p. 218, Mr. C. V. Riley is quoted as saying that "The insect within can make it [the gall] bound twenty times its own length."—EDITOR

early part of October of the previous year when the galls were discovered jumping about on the ground, but how long prior to that time they had possessed the power of such activity was not known to me.

Beginning with May, the oaks were visited periodically, and on each occasion, a number of the galls were detached from the leaves and given every opportunity and encouragement to exhibit their active powers. These visits continued into November, without my finding a single jumping specimen. The leaves were falling freely from the trees and it was no trouble to collect a quantity of the galls, but it was impossible to find one that I could take into the court of science as a witness to the truth of my claims.

I was beginning to doubt the accuracy of my observations of their jumping capacity made in the previous fall when it occurred to me that the workman who raked up the leaves from under the oak trees on the golf course would have seen the galls in their active stage, if such a thing were observable. Therefore I asked him.

"Do you mean them little seed things that hop like fleas?" was the comforting response.

When told that was what I was looking for, he said he had not seen any this year but he had seen "lots of 'em before."

That settled it. I had not been dreaming, and I was still on the highway to fame, though it will be seen soon that I was to be unceremoniously ditched by a large immovable obstruction labeled: "Known for Fifty Years."

From the date of the conversation above related to the coming of the winter storms that destroyed or carried away the foliage of the trees, I gave much time to trying to solve the

mystery, why the little galls that were so active the year before were immobile this season.

The life cycle of the Cynipidæ, like that of other Hymenoptera, embraces four periods,—those of the egg, larva, pupa, and imago or adult. As the egg and possibly the pupal periods represent inactive stages, it seemed to me probable that it is during its existence as a larva that our little cynipid imparts the jumping feature to the gall that encloses it;¹ the presumption that the insect abandons the home of its youth as soon as it reaches maturity would exclude the adult stage from consideration.

After I had arrived at this conclusion, the only question remaining was, why do not the insects cause the galls to hop this year as in the past? With the hope of discovering an answer, I collected and opened dozens of the little galls from day to day until the close of the year, when no more were to be found. The result of this investigation, I think, solved the mystery, for of all of the galls examined, only in one specimen did I find a larva that was alive. In this exceptional case, the larva was emaciated and feeble. If the insect in the gall is dead or moribund, obviously the movements that make the gall such an interesting object cannot take place. But what was the cause of such a remarkable fatality? That I could only conjecture. Possibly some

¹In the *American Naturalist*, Vol. X, p. 218, Mr. C. V. Riley states: "The motion [of the gall] is imparted by the insect in the pupa and not in the larva state." Later, however, he abandoned this view, for in the *Proceedings of the United States National Museum*, Vol. V., p. 634, he writes: "The bounding motion is doubtless caused by the larva, which lies curved within the gall, and very much on the same principle that the common cheese-skipper (*Piophila casei*) is known to spring or skip. Dr. W. H. Mussey, of Cincinnati, in a communication to the Natural History Society of that city, December, 1875, states, in fact, that such is the case; though members of the California Academy who have written on the subject assert that the motion is made by the pupa, which I think very improbable." Reprinted also in *Annals and Magazine of Natural History*, Vol. XII, Fifth Series, p. 142.—EDITOR.

parasitic enemy prevailing in overwhelming numbers, or the occurrence of weather conditions fatal to their existence, or a combination of both may have been responsible for the seemingly unusual circumstance. It is not uncommon in the insect world for certain species to appear at times in unusual numbers, then to become so scarce as to be difficult or impossible to find.

When the winter storms closed the opportunity for further investigation, as well as ending the possibility for that year of procuring any jumping galls to show persons whom I had interested in the matter, I was somewhat disappointed and a trifle chagrined, feeling that the accuracy of my statement as to the remarkable actions of the galls would not be accepted until the animated galls could be produced to prove it. However, I was soon relieved of further anxiety regarding the matter in an unexpected manner.

Through my friend, Mr. G. S. Radford of New York, who enlisted the kind services of Dr. Frank E. Lutz of the American Museum, I was brought into touch with Prof. A. C. Kinsey of the University of Indiana, who was at the time engaged in making a detailed study of the gall wasps of the Pacific Coast, working on collections that he had made two years previously. Consequently he was not only familiar with the jumping gall, but was in a position to refer to the literature bearing on the subject of this particular gall. His kind and prompt communication informed me that the gall had been brought to the attention of scientists nearly half a century ago. An account of it appeared in the *Rural Press* of San Francisco in 1874 with the description by Henry Edwards

attached, and it was written up in certain scientific publications two years later by Prof. C. V. Riley. Its name, Professor Kinsey stated, is *Neuroterus saltatorius*.

In his letter he added: "Your gall has been recorded in literature from only Stockton and Marysville, California, though I have species from a number of other localities. It is confined to the Pacific Coast." He also said that related species occur elsewhere in the United States, particularly in Florida, where similar behavior is found in the cynipid gall, *Andricus saltitanus*.

In closing his letter he said: "Your observation of this insect has indicated an unusual degree of interest and perseverance in the rather difficult task. I hope that you will not let the fact that the species is already known to science deter you from making further observations."

After some search in the public libraries, the account of the discovery of the jumping galls, referred to as having been published in the *San Francisco Rural Press*, was found. As it is not only the original but the most comprehensive description of the gall and the insect that has appeared in print, so far as I can ascertain, it is reproduced in full herewith:

"FLEA SEED," *CYNIPS SALTATORIUS*

We present this week the engraving of an insect and shell from which it emerged, for the purpose of showing our readers an object which has attracted considerable attention for the past year or two in the state.

They were first brought to notice by the curious jumping qualities possessed by what was supposed by some persons to be mustard seed, and many theories were advanced as to how the thing was done, some of which were quite amusing.

The "seed" from which the insect was obtained was gathered with a number of others, under an oak tree on the ranch of

Mrs. H. Wilder about eight miles from Marysville, by Mr. F. W. H. Aaron of that city and by him sent to Mr. Hanks, President of the San Francisco Microscopic Society. The matter was referred to Mr. Kinne for examination, who has followed their development



A reproduction of a woodcut originally published in the San Francisco *Rural Press*, showing the jumping gall and the insect that emerged from it

through to the perfect insect, and from his report we collect the following:

The gall or cocoon is found lightly attached to the leaf of the oak and in time falls to the ground, where the noise occasioned by the thousands that are leaping about without any apparent cause or organ of motion, sounds much like the falling of fine rain on the leaves. An examination shows that the extraordinary activity displayed is caused by the spasmodic contraction and concussion of the abdominal parts of the occupant against the side of the shell (enclosing it), which movement does not cease even after the covering is nearly split in halves, if the tender structure of the crysalis be not injured. That it is the crysalis and not the larva has been shown by the microscope, and its change to the perfect insect has been noted at weekly stages.

The average length of the insect is five hundredths of an inch, and in each have been found from sixty to eighty pear-shaped ova. The engraving gives its general appearance

with wings raised somewhat unnaturally, for the purpose of showing their size and shape. It was drawn by Mr. Kinne and enlarged twenty diameters. Its ovipositor is a tiny, though perfect, piece of nature's mechanism and lies encased in a sheath at the lower part of the abdomen. At a recent meeting of the "Microscopic Society," Mr. Henry Edwards furnished a report giving the following technical description of the curiosity:

**GENUS CYNIPS—*L CYNIPS SALTATORIUS*
(nov. sp.)**

Black, shining. Head broad between the eyes, which are very prominent. Antennæ 14 jointed, the 1st and 2nd joints being much swollen, and the 3rd joint longer than the other two, the remaining joints are long, simple and nearly equal. Thorax densely but finely punctured, very globose in front, projecting so far as to almost hide the head. Abdomen globose, shining. Ovipositor cases short, spatulate received into marginal groove in the body. Ovipositor itself flesh color, curved inwardly toward its middle. The abdomen is six-jointed. Terminal joint of palpi, hatchet shaped. Tarsi very hairy throughout, the anterior pair with six and the remainder with seven joints. Coxæ very globose. Tibiæ long, with large and powerful spines at the base. *San Francisco Rural Press*, February 2, 1874.

The writer has been asked a number of times if the jumping galls are not analogous to the Mexican jumping "beans." There is not only a great difference in size, but there is an altogether different origin and character of growth. The former is an excrescent of the epidermis of an oak leaf, and the latter is a seed, but the peculiar activities of both arise from a similar cause, both being inhabited by insect larvæ, one the larva of a member of the wasp family, the other the larva of a moth. The activity of the gall is apparently confined to a short period, thought not to be longer than a fortnight, but the movements of the "beans," it is said, last for several months.

NOTES

AFRICA

MARTIN JOHNSON'S PICTURES OF AFRICAN GAME.—Although many remarkable pictures of the animal life of Africa have been brought back by those who have visited that continent, those recently obtained by Mr. Martin Johnson are entitled to special praise. The excellence of his results is due in part to technical skill and the power of the long-focus lens in producing close-up views of remarkable clearness, but at least in equal measure the quality of these pictures is attributable to the purposes and spirit of the leaders of the expedition,—we say leaders because Mrs. Johnson's pluck, marksmanship, and dependable aid in the moment of danger made it possible for her husband time and again to venture into positions that otherwise would have exposed him to great danger.

Mr. Johnson went to Africa not with the sportsman's purpose of bringing back heads to hang on the wall or furs to stretch on the floor. He went there to get the best possible records of animal behavior. It was with the camera rather than the gun that he bagged his game. His pictures give every evidence that he killed animals only when they were needed for food or when he was imperiled by their furious charge and there was no other way of stopping them. With the interest focused on the animals themselves, there is in his pictures a commendable absence of the extraneous and the preposterous. Mr. Johnson spared no pains to obtain pictures that should be natural and enlightening. As an example of his care and patience, he built within a radius of forty miles no less than fifty blinds of thorn and stone to hide his cameras for close-up work, and then waited many weeks for the animals to get used to them. He was finally well rewarded, as those who have seen the results of his photography will testify.

The descriptions that accompany the pictures are informing. Through them we learn that no two zebras are marked exactly alike, that the oryx is capable of impaling a lion on its rapier-like horns, that the giraffe can deliver a death-dealing stroke with its powerful fore feet, that the ostrich never hides its head in the sand, that the rhino cannot see clearly for more than thirty-five yards. So much misinformation still exists regarding

animal behavior that it is a pleasure to witness a series of films that far from perpetuating error, or more damaging still, swelling the total of untruths, succeeds in presenting unchallengeable facts about animals.

Both the captions and the pictures have been censored by Mr. Carl E. Akeley, who has placed at the disposal of Mr. Johnson his extensive knowledge of African wild life, and by Mr. George H. Sherwood, curator of public education in the American Museum. The films are endorsed by the American Museum as a scientific record of the free wild animals in Africa in their native haunts. When the pictures were shown at the American Museum on March 9 the total attendance was 4098,—representing more than twice the seating capacity of the auditorium. Mr. Johnson kindly consented to show the film a second time and a number of those who could not gain admission at first waited till ten o'clock for the privilege of seeing the films.

Mr. and Mrs. Johnson spent two years in securing the pictures. Their route extended from the Thika River, near Nairobi, where they organized their safari (African for expedition,—across the equator, past snow-capped Mount Kenia, through waterless stretches of the Gusoot Desert, on to the goal of their exploration), a lake near the Abyssinian border, which, because of its soul-satisfying beauty, they rechristened Lake Paradise.

Mr. Johnson has traveled in the outlying parts of the world for more than twenty years. Originally a member of the expedition of the "Snark" in company with Jack London, he has since voyaged in the South Pacific, believing it the region of the greatest appeal. Today Africa has supplanted the South Pacific in his affections and he is contemplating a return to that continent for a sojourn of five years, to be devoted to the working-out in pictorial records of the life histories of many of its native animals.

ANIMAL LIFE OF THE HIGHLANDS OF THE GREAT CRATERS.—Although the so-called "craters" of the moon reach a size that makes even the largest craters of our earth seem insignificant in comparison, a crater that has a diameter of twelve miles and the circumference of which, measured along the unbroken

ring of cliffs that rampart it, is believed to be about thirty-five miles, may well fill one with awe. Ngorongoro in Tanganyika Territory (formerly German East Africa) is spoken of as such a crater and, though it is the largest formation of its kind in the area and rivals if it does not surpass in size the crater of Asosan in Japan, it is but one of several similar mountain-girt enclosures that have earned for the region the name, Highlands of the Great Craters.

In the days when, it is thought, the lava boiled in Ngorongoro and an incandescent glow rose at night from the fiery molten matter, the spectacle must have been magnificent. Today, however, there stretches over the surface of Ngorongoro a rich grassy carpet, and on its floor is revealed a scene very different in kind, it is true, but not less impressive than that which would be presented by volcanic activity. Ngorongoro is today the pasture ground of vast numbers of the great browsing animals, as well as a stalking place for many of the clawed beasts of prey that in this remote area, safeguarded by the forbidding character of the surrounding country, still enjoy a degree of immunity from attack by man.

Mr. T. Alexander Barns, who was apparently the first to present an account of the region in English¹ and who has been lecturing regarding it before American audiences, speaks of the extraordinary abundance of animal life in Ngorongoro and in other parts of the general area. His descriptions conjure up a picture as replete with moving herds as our own western plains before the railroads laid an iron grip upon the romping grounds of the bison and the antelope. Mr. Barns saw "thousands of blue wildebeeste and thousands of zebra"; in fact, so great were the herds that notwithstanding the ample expanse of Ngorongoro, there was in many places what he describes as a "crush of game." Although "not filling the landscape to the extent that the gnu and zebra did," there were many other animals. Kongoni hartebeeste and Thompson's gazelle were present in abundance, as well as the rhino, Grant's gazelle, Chandler's reedbuck, oribi, lion, cheetah, hyena, jackal, baboons in bands of a hundred or more, ostrich and many smaller birds.

It is to be hoped that, with the example furnished by other parts of Africa of rapid

¹"The Highlands of the Great Craters" by T. Alexander Barns, *The Geographical Journal*, Vol. LVIII, No. 6.

and ruthless extinction of game, this area, apparently one of rarely surpassed richness in respect to its fauna, may be properly conserved.

ASIA

THE FAUNTHORPE INDIAN EXPEDITION.—The reports by letter and by cable that are reaching the American Museum from Mr. A. S. Vernay, joint leader of the Faunthorpe Indian Expedition, indicate that the purposes of the expedition are being progressively realized, complete material for several of the groups planned, such as the nilgai, swamp deer, and chital, having already been collected.¹

Early in February the expedition reached Bhopal State, where Mr. Vernay had the good fortune to secure specimens of the exquisite little chinkara gazelle (*Gazella bennetti*). This graceful animal is only about two feet high measured to the shoulder and weighs in the case of the male about fifty pounds. Notwithstanding its small size it carries a fine pair of ringed horns; those of one of the specimens shot by Mr. Vernay measured eleven inches. All that is now needed to complete the chinkara group is a fawn, and this has been graciously promised by the Crown Prince.

A group of sambur (*Cervus unicolor*) is also assured. Just after dawn one morning Mr. Vernay obtained a male specimen of this the largest of Indian deer, which with its erectile mane and fine antlers presents a striking appearance. Blanford in his *Fauna of British India* says that any sambur antlers "over 35 inches in length are of good size." The antlers of the specimen shot by Mr. Vernay measure 42 inches. A doe and a fawn of the sambur will be readily obtainable, thanks to the helpful interest of the Crown Prince, and will round out the group.

In Bhopal State Mr. Vernay collected also a fine langur. He had occasion subsequently to watch a band of these long-tailed monkeys munching their meal while one of their number, a sentry, searched the jungle to detect the possible presence of their enemies, the tiger and the leopard. Impressed by the inoffensive behavior of this contented band, Mr. Vernay refrained from shooting.

Among the birds obtained by the expedition are "two very good floricans, spoonbills, gray hornbills, a rare ibis, and others."

¹See NATURAL HISTORY, March-April, 1922, pp. 193-94.

On March 19, Mr. Vernay cabled from Lucknow that by the gracious permission of the Maharajah of Nepal he had secured three exceptionally fine rhinoceroses,—two bulls and a cow. The Maharajah rendered invaluable service to the expedition, providing elephants and coolies for transport as well as the supplies required. In addition to the three rhinoceroses, which are particularly valued because of the fact that this animal is rapidly disappearing, a tiger, a tigress, and a bear were also secured.

AMPHIBIANS

At the Thirty-ninth Session of the American Association of Anatomists, held at the University of Chicago, March 28-30, Dr. G. Kingsley Noble read a paper on "The Carpus of Eryops and the Structure of the Primitive Chiropterygium." The paper was a summary of the embryological, myological, and palaeontological investigations being carried on by Dr. W. K. Gregory, Mr. R. W. Miner, and the speaker. Although it is usually stated that the hand and foot were primitively five-rayed—that is, had five digits,—this synthesis of embryological and palaeontological work showed conclusively that the earliest land vertebrates must have had a seven-rayed hand and a seven-rayed foot. The first, or inner ray, was a short, supporting prop, while the last, or outer digit, was also reduced in even the most primitive tetrapods. On the basis of these investigations, a comparison was made between the hand of the amphibian and the pectoral fin of certain fish—the probable ancestors of the land vertebrates. The gap between fish and land animals is not so great as usually believed.

Doctor Noble also spoke before the Biological Seminary of Princeton University, April 27, on "Some Observations on the Habits and Development of Local and Exotic Batrachians," presenting a summary of the field work and studies on amphibian embryology he made in Guadeloupe in 1914, in Peru in 1916, and in Santo Domingo as well as in the state of New Jersey during 1922.

EARLY MAN

THE NEW FOSSIL MAN OF JERSEY.—The reported discoveries of prehistoric human skulls in the Island of Jersey, England, and in Patagonia, have aroused widespread interest in the public press. Naturally until more definite information is received, nothing very satisfactory can be said about these finds.

Previous discoveries of prehistoric remains in the Island of Jersey include a number of molar teeth described by Mr. R. Maret and by Prof. Arthur Keith in 1911. These show in an extreme condition the lengthening of the tooth and the deepening of the pulp cavity that have also been seen in some of the Krapina (Croatia) Neanderthals. The teeth discovered in Jersey were associated with flint implements of Mousterian type. The new find is compared in the preliminary dispatches with *Pithecanthropus*; it is more probable that it represents a Neanderthal man. Sir Arthur Keith's report on this specimen will be eagerly awaited.

ALLEGED TERTIARY MAN OF PATAGONIA.—With regard to the Patagonian discovery, the outstanding feature is the statement that the skull was found in a sandstone of Tertiary age. The first matter of importance to paleontologists, however, is to ascertain the meaning of the term "Tertiary" as used in this connection. Many South American geologists and paleontologists, accepting the determinations of the late Prof. Florentino Ameghino, have referred to the Tertiary Age certain formations which, all northern paleontologists are agreed, were deposited in the Quaternary or even later times. Professor Ameghino reported the occurrence of several fossil human skulls in formations of relatively great antiquity in South America, but these specimens have been examined by Doctor Hrdlička, of the United States National Museum and other authorities, and they regard them as belonging to Indians. Northern geologists, also, who have examined the geological formations adjudge them to be much later than Tertiary.

If, however, the Tertiary age of this Patagonian skull should eventually be established, this discovery will not be so entirely revolutionary as might appear. The evidence for the Tertiary age of man in Europe is now being accepted by leading archæologists of Europe, and in this country Professor Osborn was one of the first to come to the support of Mr. W. Reid Moir, who has long held that the flints in the Red Crag and related formations of Pliocene age in southeastern England were of human make and not merely the accidental results of stream action and other natural forces upon broken fragments of flint. It was thought by some authorities, too, that the Vero man of Florida dated back to the Pliocene, although the weight of the testimony seems to indicate a later age.

COMPARATIVE ANATOMY

TWO IMPORTANT CONTRIBUTIONS.—"The Evolution of the Human Foot" is the title of an important paper by Dr. Dudley J. Morton in a recent number of the *American Journal of Physical Anthropology*.¹ Doctor Morton, whose studies have been conducted in the department of comparative anatomy, American Museum, presents strong evidence for the view that the structure of the human foot still bears the traces of its remote derivation from an apelike foot, with the ability to grasp the branches of trees. He shows that the feet of infant gorillas are more adapted for grasping and climbing, while the feet of the heavy-bodied adult gorillas, which spend most of their time on the ground, show significant advance towards a subhuman type.

Another article of interest to students of evolution is that on "The Piltdown Jaw," by Dr. Aleš Hrdlička, in the same journal. The author has recently studied this famous specimen in the British Museum in great detail. He concludes "that it is no longer possible to regard the jaw as that of a chimpanzee or of any other ape, but that it is the jaw of a human precursor or of very early man. Dr. Smith Woodward's designation of this form as being from the dawn of the human period seems very appropriate."

ERWIN S. CHRISTMAN

The late Erwin S. Christman's bronze group of two running horses, called "The Rivals," a copy of which is on exhibition in the new hall of horses, American Museum, continues to receive deserved recognition in the art world. Several prominent sculptors have recently given high praise to this spirited group, and the two leading bronze dealers of the city have put it in a position of honor in their collections.

MAMMALS

FIELD WORK IN ECUADOR.—Mr. G. H. H. Tate, who for two years has been collecting mammals in Ecuador for the American Museum, is on his way to that country, after a brief sojourn in New York, to resume his field work. His plan, subject to modification as circumstances may dictate, calls for an extended period of hunting and trapping as well as the gathering of scientific data in selected areas of Ecuador. As much of this

program as possible will be undertaken during the coming twelve months. He expects to work on the coast, traversing first the arid Manta region, where are located Monte Cristi and Jipijapa, famous as the producing centers of the best Panama hats, and then the moist coastal region that lies beyond and that becomes increasingly humid as one moves north. Possibly he may work as far north as Pata de Pajero, a mountain of undetermined altitude near Pedernales and the probable high point in the coastal range that backs the shore line of Ecuador. This whole area has been explored zoologically to only a trifling extent and though it may be predicted with reasonable certainty that animals like the ocelot, raccoon, coatiundi, agouti, and paca will be found there, the real character of the fauna in its completeness is a thing still to be revealed.

Another region to which Mr. Tate will devote attention is that of the mountainous country about Quito, with special reference to some of the principal type localities like Santo Domingo, Rio Pita, and Cayambe, the purpose being to complete the collections from this area and to round out and verify the classical data of earlier workers.

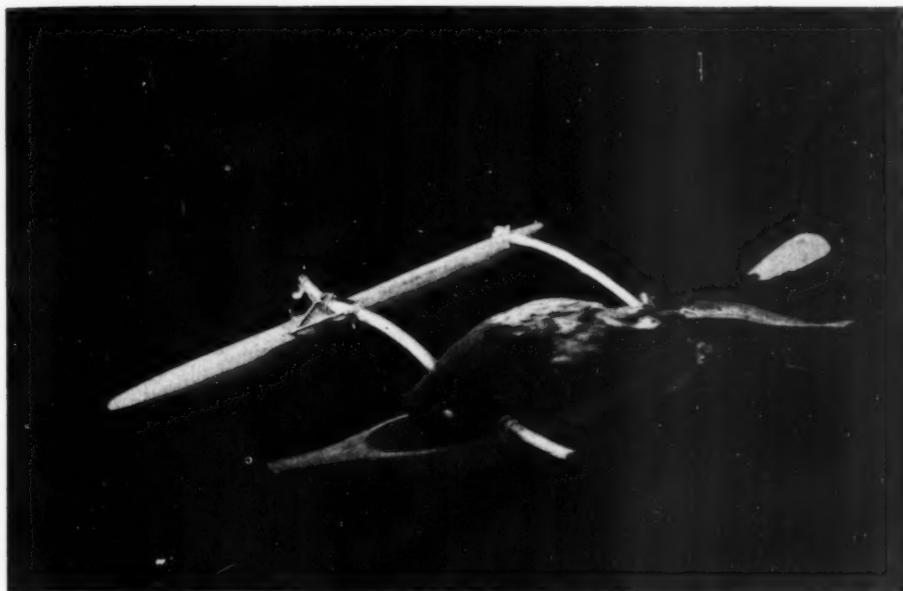
Papallacta, representing the high paramo zone, will also be visited. It is here that is found the Ecuadorian *Pudu*, a little deer of great rarity. Mr. Tate will likewise work over the region that lies between Quito and Esmeraldas, which is almost unknown zoologically and is probably difficult to traverse, being for the most part a very humid area covered with heavy vegetation. Finally, the plan provides for a visit to the densely forested Amazonian country in the neighborhood of the isolated mountain, Sumaco, which rises to a height of 13,000 feet. Here it is hoped that material new in character may be secured.

BIRDS

A BOATLOAD OF PEALE'S PETREL.—The capture of the fourth known specimen of Peale's petrel (*Pealea lineata*) by the leader of the Whitney South Sea Expedition fills the last generic gap in the American Museum's collection of Tubinares, the fascinating order of sea birds which includes the albatrosses, shearwaters, and Mother Carey's chickens.

Nearly a year ago a member of the committee in charge of the Whitney Expedition closed a letter to Mr. Rollo H. Beck with the facetious comment, "Be sure to send us a

¹*American Journal of Physical Anthropology*, Vol. V, No. 4, October-December, 1922.



A boatload of Peale's petrel

boatload of Peale's petrel." On Christmas day, 1922, after the Museum's schooner, the "France," had returned to Tahiti from a long cruise among the Marquesas Islands, Mr. Beck replied, "Due to your kindness in not mentioning the size of the boat, I am able to comply with your request."

The meaning of this somewhat cryptic message was not clear until the consignment of Polynesian material was opened in the Museum in March. Then, in the middle of a large case of bird skins, a single Peale's petrel was found resting in a miniature outrigger canoe. Its appearance was hailed by the ornithological staff with such enthusiasm as ardent Egyptologists might show over the unwrapping of a new Pharaoh.

The first specimen of this rare petrel was obtained by Titian R. Peale at Upolu, of the Samoan group, during the celebrated United States Exploring Expedition of 1838-42, and was described and figured by Peale in his excessively rare volume on the birds and mammals collected by that expedition, which was published in 1848. The type skin is still in the National Museum at Washington. Since the original discovery of the species, three additional examples have been taken. Two of these are from New Zealand waters, and are preserved in the Paris Museum and the British Museum respectively. The fourth

specimen, which has been removed from its canoe to one of the dust-proof steel cabinets of the American Museum, is a female which Mr. Beck collected off Huapu or Adams Island of the Marquesas group, in September 1922. Like Peale's example from Upolu, it seems to have been a nesting bird.

—R. C. M.

COLLECTING FOR MUSEUMS VERSUS DESTRUCTION FOR SPORT OR GAIN.—An inventory of the bird collections of all the museums in the world is now being made by Dr. T. S. Palmer of the United States Biological Survey in the National Museum. While the figures are still far from complete, Doctor Palmer says that in all the museums of the world there are preserved about three million birds, of which a million, perhaps, are found in the museums of the United States. These figures are only approximate, but they enable us to contrast the use of birds for scientific purposes during the entire past century with the *destruction* of birds in a single year for purposes of the sportsman and market hunter. For example, in the state of Minnesota alone, from a million to two million ducks and geese are killed in a single year. Probably many times this number are killed in the United States and in the world at large each year for the market, a total vastly exceeding that of the specimens collected for scientific study in a whole

century. This is certainly sufficient answer to those who criticize collecting for museum purposes.

FISHES

FLYING FISHES AND AÉRONAUTICS.—A three-page note on "flying fishes and soaring flight" by Dr. E. H. Hankin in the *Proceedings of the Cambridge Philosophical Society* (February 8, 1923) mentions facts which, the author concludes, "indicate that the flying fish is likely to be a useful guide in attempts to achieve artificial soaring flight." He also expresses the opinion that "the flying fish is by far the most efficient of existing soaring animals in respect of power of carrying weight in a horizontal direction."

It may be appropriately mentioned that this heavy loading per unit area of wing surface possessed by flying fishes is also stressed in a paper of similar tenor and somewhat wider scope by R. E. Dowd, entitled "The Aéronautics of the Flying Fish," which was based on an examination of material in the American Museum, read before the Aéro Club of Ithaca, New York, December 16, 1920, and published in the *Aërial Age Weekly*, January 10, 1921. Both authors note the under surface projection of the ribbing of the flying fish pectoral as a detail of soaring efficiency.

It cannot but be gratifying to ichthyologists to see the study of fishes playing a part in the coming of man's mastery of the air, and to see the flying fish accorded due honors.—J. T. N.

"THE ELASMOBRANCH FISHES," BY J. F. DANIEL.—The University of California is to be congratulated on a recently published book entitled *The Elasmobranch Fishes*, by J. Frank Daniel, professor of zoology in the university. Elasmobranch fishes comprise sharks, skates, and rays. Skates and rays are essentially sharks with a specialized flattened body form.

Professor Daniel's book is a monographic review of the anatomy of sharks, which are the most primitive true fishes, those which have inhabited the earth since the earliest times and which are unquestionably ancestral to all more highly specialized forms, that is to say, the entire vertebrate phylum from mudfish to man. To know of them is, therefore, of the greatest interest, and this authoritative, comprehensive work on their structure is correspondingly important. Along with an essentially primitive character, certain members of the group show structures which are of

interest because of their high degree of specialization, for instance, in the reproductive system. In an advanced embryo of the butterfly ray, a viviparous species, villi from the uterine wall of the mother enter the spiracle and supply nutriment direct to the digestive tract, as can be demonstrated by opening up the digestive tract of the embryo. In certain rays there is present an electric organ by means of which electric shocks can be generated. This is one of the most highly specialized organs found in the animal kingdom.

The seven-gilled shark of the Pacific Coast, one of the most primitive living species, is used as a standard for comparison, in each of the eleven chapters of the book treating of the structures and anatomical systems of sharks. At the close of each chapter there is a carefully prepared bibliography, making of the whole a useful key to unlock the considerable and important literature bearing upon the group. The work is thus simply and well arranged for reference. It is profusely and most attractively illustrated. In its appearance as well as in its substance the book is one in which all concerned may well take pride.

LOWER INVERTEBRATES

LOWER INVERTEBRATES FROM BRITISH GUIANA.—Through the kindness of Mr. Herbert Lang and Mr. William J. La Varre the department of lower invertebrates, American Museum, has come into possession of a total of 1078 specimens collected during Mr. Lang's recent trip to British Guiana. Most of these specimens were taken from 150 to 180 miles inland, at such localities as Kamakusa, Kurupung, and Meamu in or near the area of the Diamond Workings, but some were obtained at Georgetown and Bartica. Included in the collection are 458 mollusks (of which the greater number are land snails), 268 crustaceans (among which the isopods are of especial interest), 292 myriapods, and 41 annulate worms. Particularly valued, because of their rarity, are 16 specimens of *Peripatus*, a group of invertebrates occupying, it is believed, an intermediate position between the segmented worms and the true arthropods. This collection supplements in an effective way that recently donated by Mr. William Beebe from the region of Kartabo, in which a number of estuarine forms find place. The isopods of both collections are being studied by Dr. Willard G. Van Name, who is

preparing a *Bulletin* regarding the isopods of the West Indies and of South America as represented in the collections of the American Museum.

INVERTEBRATES COLLECTED BY THE CANADIAN ARCTIC EXPEDITION.—A notable addition to our knowledge of the invertebrate animals of the arctic regions has been made in the Report of the Canadian Arctic Expedition of 1913-18, led by Vilhjalmur Stefansson and Rudolph M. Anderson, that is now being published by the Canadian Government. Volumes VII, VIII, and IX of the Report (in which most of the invertebrates—exclusive of the Insects, covered in Volume III—collected by the expedition are dealt with) have been appearing in parts, but the completion of the volumes may be expected soon.

The fauna of the arctic regions had already been too extensively studied to allow of the discovery of new species in large numbers, but much was learned regarding the distribution of forms already known, especially in the region lying north of western Canada and Alaska, the fauna of which had been little investigated. The articles dealing with the various groups have been prepared by more than thirty zoologists, mostly of the United States and Canada, a number of whom have gone much beyond a mere description and discussion of the material collected by the expedition and have prepared reports that are of much wider interest. Among these may be mentioned that of A. E. Verrill on the Alcyonaria and Actinaria, which is profusely illustrated and deals with many species that range south along the New England coasts; those on the marine and parasitic copepods by Arthur Willey and Charles B. Wilson respectively, the former for its numerous descriptions and illustrations, and the latter for its lists of all the known parasitic copepods of the Polar regions; that on the Gephyrea by Ralph V. Chamberlin for its complete bibliography of the group; and that on the Euphyllopoda by Frits Johansen for its descriptions and for its information on the habits and ecology of the species considered.

ANTHROPOLOGY

FRANCISCO GONZALES GAMARRA AND HIS ART.—For some time there was on exhibition in the Southwest Indian hall of the American Museum a collection of water colors, pen and ink drawings, and etchings by the Peruvian

artist, Francisco Gonzales Gamarra. Señor Gamarra is a master of color effects, using his pigments daringly but without overstepping the bounds of good taste or producing a color combination that is other than harmonious. Doubtless his art has been influenced by his study of the decorative work of the Incas, a subject which was the thesis of his doctorate, for in the ancient textiles and pottery of Peru there is a similar employment of brilliant yellows and reds. Indeed, several of his pictures are copies of designs derived from fabrics, pottery plates and water jars, wooden vases, and other ornamented objects in the museums or private collections of Peru.

It is in the portraying of Quichua Indian types that his art is perhaps at its best. In these Indians of nonchalant and graceful carriage, with their bright shawls and hats of unusual shape—the manner of dress and the ornaments worn being suggestive in this respect and in that of the Inca days—Señor Gamarra has found subjects that lend themselves to vivid portraiture.

Other pictures in the collection are the Cathedral of Cuzeo, the best example of architecture left by the Spaniards; the Church of Santo Domingo, built on the walls of the Temple of the Sun; an unfinished sketch entitled "The Coronation of the Inca"; and a fine picture of a cowled monk deeply absorbed in reading a book, the somber simplicity of his brown garb in contrast to the rich inlay of blue mosaic that studs the walls of the room and the soft red of the brick flooring.

Since the last issue of NATURAL HISTORY the following persons have been elected members of the American Museum:

Patron: MRS. WALTER WEHLE NAUMBURG.

Fellow: MR. S. BAYARD COLGATE

Life Members: MESDAMES DWIGHT J. BAUM, WM. WADE HINSHAW, EDWARD F. HUTTON, A. GRAHAM MILES, JAMES TOLMAN PYLE, DOUGLAS ROBINSON, THEODORE ROOSEVELT, SR., W. AUSTIN WADSWORTH; MISS CLARA F. STILLMAN; DR. FOSTER KENNEDY; THE REVEREND TERTIUS VAN DYKE; MESSRS. IRVING W. BONBRIGHT, WILSON CATHERWOOD, JOHN NOYES MEAD HOWELLS, ROLAND JACKSON HUNTER, ARTHUR KORTH, WILTON LLOYD-SMITH, WM. J. RYAN, WILLIAM RYLE, H. SANDHAGEN, CHARLES E. SCHLEY, CHARLES H. SCOTT, P. SHAW SPRAGUE, HENRY OSBORN TAYLOR, SETH E. THOMAS, JR., T. GAILLARD THOMAS, AND HAROLD T. WHITE.

Sustaining Members: MRS. E. WALPOLE WARREN; MISS ANNETTE TILFORD; MESSRS. FLOYD L. CARLISLE, CHAS. M. DUTCHER, HANCKE HENCKEN, LEWIS A. HIRD, AND JOSEPH KOHNSTAMM.

Annual Members: MESDAMES JOHN STORM APPLEBY, GEORGE E. CLAFLIN, JAMES F. CURTIS, BLANCHE W. FREEMAN, ALVA O. GREIST, JESSE HIRSCHMAN, PHENIX INGRAHAM, R. S. KELLOGG, SAMUEL KRIDEL, JAS. D. LAYNG, JR., DAVE H. MORRIS, SIDNEY NEW, SHEFFIELD PHELPS, WM. SCOTT PYLE, GEORGE H. RICHARDS, J. WEST ROOSEVELT, FRANK D. SKEEL, WILLIAM A. SLATER, CLARENCE BISHOP SMITH, R. PENN SMITH, JR., EDGERTON SWARTWOUT, FRANCIS B. SWAYNE, CHARLES NEWHALL TAINTOR, JOSEPH B. THOMAS, LEWIS S. THOMPSON, ALFRED B. WADE, AUGUSTUS B. WADSWORTH; THE MISSES MARY C. CRIMMINS, ELOISE HOWARD, RACHEL HOPPER POWELL, M. M. REESE, HENRIETTA RHOADES, H. RICKETTS, JANE E. SCHMELZEL, CORINNE A. SHERMAN, ALLIE SPIES, ANNE R. WEIR, ELIZABETH R. WELLINGTON; BRIGADIER-GENERAL SAMUEL E. TILLMAN; DOCTORS MARY M. CRAWFORD, GUSTAV A. FRIED, F. S. MANDELBAM, LUCIUS A. SALISBURY, WILLIAM LORD SMITH, FRED B. SUTHERLAND, L. M. WAUGH, CHARLES L. WEIHER; THE REVEREND CALEB R. STETSON; MESSRS. NELSON I. ASIEL, JOSEPH BARNETT, ANTON BASKY, ED. E. BECHTEL, JOSEPH C. BELDEN, SAMUEL BENSON, WM. M. BERNARD, ELY R. CALLAWAY, ARTHUR B. CUDDIHY, WILLIAM DETTE, CHARLES W. DUSTIN, HERMAN A. ELSBERG,

HENRY ESTRICHER, THEO. FOULK, HERBERT C. FREEMAN, JOHN D. HAGE, ALBERT CLARENCE HEGEMAN, HENRY HELLMAN, HENRY HOLT, SILAS W. HOWLAND, GEORGE H. HUTZLER, E. LOUIS JACOBS, WILBUR S. JOHNSON, ARTHUR W. JONES, JR., WILLIAM B. JONES, CORNELIUS F. KELLEY, WILLY LEVY, HENRY S. LIVINGSTON, HENRY E. MENDES, G. B. MOFFAT, HAROLD NATHAN, CHARLES W. OGDEN, WILLIAM REMSEN, LLOYD RICHARDS, GEORGE BARCLAY RIVES, JAMES H. ROBINSON, WILLIAM A. ROCKEFELLER, JAMES BRYANT ROY, JUSTUS RUPERTI, MARSHALL RUSSELL, R. SANFORD SALTUS, JR., EDWARDS S. SANFORD, W. J. SCHIEFFELIN, JR., FREDERICK A. SEAMAN, EDWARD G. SPARROW, E. VAIL STEBBINS, C. J. SYMINGTON, DAVID TAYLOR, EDWIN P. TAYLOR, JR., STEPHEN H. THAYER, S. WADSWORTH, MAURICE WERTHEIM, R. M. STUART WORTLEY; THE CITY AND COUNTRY SCHOOL AND ST. CATHARINE'S ACADEMY.

Associate Members: MRS. ROBERT J. SIMPSON; MISS MARY LISA; DOCTORS JOHN C. BALDWIN, H. C. BRADLEY, GEORGE SLOCUM, A. G. VESTAL; THE REVEREND W. F. BUMSTED; MESSRS. EDWARD G. AINLEY, PAUL A. ANDERSON, CHARLES G. CHAPMAN, C. WILLIAM CRAMER, JOSEPH F. GALLOWAY, WILLIAM H. GIBSON, E. Y. GUERNSEY, J. C. HUSTON, H. M. MERRIMAN, JR., E. J. B. SCHUBRING, HARRY R. SINCLAIR, THOMAS M. SMITHER, L. L. SYNDER, C. H. STUART, JOHN A. THOMPSON, STILLMAN F. WESTBROOK; THE BERKSHIRE ATHENÆUM AND THE OREGON STATE LIBRARY.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1868

MEMBERSHIP MORE THAN SIXTY-EIGHT HUNDRED

For the enrichment of its collections, for the support of its explorations and scientific research, and for the maintenance of its publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 6800 members are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Associate Member (nonresident)*	annually	\$3
Annual Member	annually	10
Sustaining Member	annually	25
Life Member		100
Fellow		500
Patron		1,000
Associate Benefactor		10,000
Associate Founder		25,000
Benefactor		50,000

*Persons residing fifty miles or more from New York City

Subscriptions by check and inquiries regarding membership should be addressed: George F. Baker, Jr., Treasurer, American Museum of Natural History, New York City.

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM FREE TO MEMBERS

NATURAL HISTORY, published bimonthly by the Museum, is sent to all classes of members as one of their privileges. Through NATURAL HISTORY they are kept in touch with the activities of the Museum and with the marvels of nature as they are revealed by study and exploration in various regions of the globe.

COURSES OF POPULAR LECTURES FOR MEMBERS

A series of illustrated lectures, held in the Auditorium of the Museum on alternate Thursday evenings in the fall and spring of the year, is open only to members and to those holding tickets given them by members.

Illustrated stories for the children of members are told on alternate Saturday mornings in the fall and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members. When visiting the Museum, members are also privileged to avail themselves of the services of an instructor for guidance.

The American Museum of Natural History has a record of more than fifty years of public usefulness, during which its activities have grown and broadened, until today it occupies a position of recognized importance not only in the community it immediately serves but in the educational life of the nation. Every year brings evidence—in the growth of the Museum membership, in the ever larger number of individuals visiting its exhibits for study and recreation, in the rapidly expanding activities of its school service, in the wealth of scientific information gathered by its expeditions and disseminated through its publications—of the increasing influence exercised by the institution.

In 1922 no fewer than 1,309,856 individuals visited the Museum as against 1,174,397 in 1921, and 1,038,014 in 1920. All of these people had access to the exhibition halls without the payment of any admission fee whatsoever. The EXPEDITIONS of the American Museum, working during the past year in several parts of Asia—where finds of extraordinary value were made—in South America, Africa, Australia, Europe, in the South Pacific Islands, in the West Indies, and in selected areas of our North American continent, have greatly enriched knowledge. Many habitat groups, embodying specimens secured by these expeditions, are planned for the new Museum buildings, the erection of which has been authorized by the city.

The SCHOOL SERVICE of the Museum reaches annually more than 4,000,000 boys and girls, through the opportunities it affords classes of students to visit the Museum; through lectures on natural history especially designed for pupils and delivered both in the Museum and in many school centers; through its loan collections, or "traveling museums," which during the past year circulated among 475 schools, with a total attendance of 1,648,608 pupils. During the same period 330,298 lantern slides were loaned by the Museum for use in the schools as against 209,451 in 1921, the total number of children reached being 2,582,585.

LECTURES, some exclusively for members and their friends, others for the general public, are delivered both in the Museum and at outside educational institutions.

The LIBRARY, comprising 100,000 volumes, is at the service of scientific workers and others interested in natural history, and an attractive reading room is provided for their accommodation.

The POPULAR PUBLICATIONS of the Museum, in addition to NATURAL HISTORY, include Handbooks, which deal with the subjects illustrated by the collections, and *Guide Leaflets*, which describe some exhibit, or series of exhibits, of special interest or importance, or the contents of some hall or some branch of Museum activity.

The SCIENTIFIC PUBLICATIONS of the Museum, based upon its explorations and the study of its collections, comprise the *Memoirs*, of quarto size, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued since 1881, in octavo form, dealing with the scientific activities of the departments, aside from anthropology; the *Anthropological Papers*, recording the work of the staff of the department of anthropology; and *Novitates*, devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matters.

*A detailed list of the publications, with prices, may be had upon application to the Librarian,
American Museum of Natural History, New York City*